ALTERNATIVE THEORIES OF WAGE DETERMINATION: THE CASE OF ITALY

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I would like to dedicate this thesis to Ale.

DECLARATION

Chapter five of this thesis is based upon joint work with Barry Reilly which was published as "Wage Discrimination and Female Occupational Intensity", in *Labour*, Vol.5, 1990.

Section 3.1 in chapter six of this thesis is based upon joint work with Carlo Dell'Aringa. Some of the results reported there have been published in the article: "Wage Determination and Union Bargaining: An Efficiency Wage Approach", in R. Brunetta and C. Dell'Aringa (eds.), *Labour Relations and Economic Performance*, Macmillan, 1990.

SUMMARY

This thesis is an empirical study of wage determination mechanisms in the context of the Italian economy. The research presented here addresses a number of issues concerning theories of wage determination, and investigates their relevance for a better understanding of the functioning of labour markets. In particular, the thesis intends to evaluate the adequacy of traditional competitive theory for the explanation of several labour market phenomena.

The approach adopted uses econometric techniques and micro-data (at the individual level) to investigate the determinants of pay levels and the structure of wages in Italian manufacturing industry.

The vast literature on wage determination of the post-war era extensively documented the existence of large and persistent wage differentials among industries and workers of comparable skills. The empirical evidence analysed in this work suggests that the structure of relative industry wages is very stable over-time. The results obtained provide no evidence in support of the view that wage dispersion can be explained by either unmeasured workers characteristics or compensating wage differentials. Conversely, the pattern of industry-occupation wage differentials seems to suggest that rent sharing mechanisms and fairness considerations are important determinants of wage levels. A significant wage dispersion was also detected among firms operating in the same sector. Firm size, product market conditions and firm's financial structure, through their effect on ability-to-pay, proved to be central features of firms' pay policies. Firm's profitability, in contrast with the view commonly held, showed a positive impact on wage levels.

A common finding of empirical studies on wages is that women are paid less than comparable male workers. Our findings for the Italian economy indicate that, although male/female pay differences - on average - are not large in magnitude, nevertheless women tend to be segregated in low pay jobs with poor advancement prospects.

In Italy, wage formation is characterised by a two-stage procedure. In the first stage, negotiation between trade unions and employers set a wage level which can be subsequently modified, in the second stage, by overpayments at the firm level. This second stage originates the so called "wage drift". The analysis in this thesis considers the empirical relevance of wage drift, in pay setting mechanisms, for productivity and bargained wage levels. A positive effect of overpayments on productivity was detected and an efficiency wage interpretation is offered. Firms' discretionary payments were shown to be shaped so as to reduce shirking, increase effort and retain high quality workers.

Finally, if labour relationships are characterised by long term employer-employee attachment, then the traditional "spot" labour market characterisation does not appear well suited to explain job tenure. A "career" labour market interpretation, where *internal* rather then *external* mobility is important, can provide a better framework of analysis. The analysis of the determinants of job duration showed that: high educational attainments, work experience and firm size - *ceteris paribus* - have a negative impact on the probability of job separation.

CHAPTER ONE

Introduction

In 1976 the Italian Ministry of Labour set up a Parliamentary Commission with the purpose of investigating the wage structure. The so-called "Commissione Coppo" produced evidence showing that the Italian wage system was characterised by large wage differences across industries and occupations. The results of the research contributed much to the idea that the Italian wage determination system was a sort of "giungla retributiva" (remuneration jungle) where comparable workers doing apparently similar job were paid differently. The following decade experienced some major changes both in the field of legislative intervention and in union bargaining practices. The former were mainly intended to set equitable pay and working conditions between male and female workers, and between public and private sector employees. In the same years a major revision of the wage indexation mechanism (the so-called "contingenza") also took place. As far as bargaining practices are concerned, in the 80s' the structure of negotiations marked a departure from highly centralised bargaining and from egalitarian pay policies - which had characterised the previous decade - towards more decentralised and differentiated wage agreements.

In order to evaluate the extent to which the major changes which occurred had an impact on the structure of wages, the Ministry of Labour in 1988 - almost a decade later - set up a new Parliamentary Commission ("Commissione Carniti") to investigate the issue of wage determination in the Italian economy. After having

analysed several different statistical sources on remunerations, the "Commissione Carniti" produced a picture of the Italian wage determination system which did not differ substantially from the conclusions reached by the "Commissione Coppo" a decade earlier. Despite the major changes occurring in pay practices, the Commission reported the existence of significant differences in wages which could not be easily explained in terms of differences in economic efficiency. The main findings suggested that the objective of "equal pay for equal work" was not supported by the empirical evidence analysed. The existence of wage differentials across industries, occupations, firm size, gender, job seniority, educational attainments - among others - was difficult to reconcile with traditional economic theory. In other words, the law of one price did not seem to accord with the observed evidence for the Italian labour market[1].

In the main conclusions the Commission suggested that some factors appeared to be systematically correlated with the existing wage differences, namely: firm size and product market power, the bargaining strength of negotiating parties, the capital intensity of production and several indicators of financial performance. Although a large debate, among economists and policy makers, followed the publication of the results of the work of the "Commissione Carniti", nevertheless there was still uncertainty as to which policy measures should be implemented to reduce wage dispersion. The research provided extensive evidence on several issues concerning wage determination, though its main conclusions can be questioned on several grounds. The main drawback comes from the fact that most of the empirical findings of the Commission, being based on the analysis of aggregate data, only allow the investigation of wage phenomena by looking at average differences. This still leaves open the question of whether observed wage patterns can be due to compositional

[1] Further evidence, drawn from aggregate data, concerning the ability of competitive theory to fit the behaviour of the Italian labour market for the post-war period can be found in, Lucifora (1987). Therein, a test of the market clearing model led to the rejection of the hypothesis that the Italian labour market was characterised by the working of competitive forces, conversely a disequilibrium framework proved better suited to explain the observed facts. Most of the work contained in this thesis was stimulated by these previous findings.

effects or to some unobserved characteristics. In order to empirically evaluate the relevance of alternative wage determination theories both a different data set (micro-data) and a different methodology seem more appropriate. It should be noted that, given the lack of adequate data for Italy, empirical evidence on these issues has been relatively scarce.

The purpose of this thesis is to address a number of issues concerning theories of wage determination using such a large data set at the individual level and an appropriate methodology. The approach to be adopted is to empirically examine the relevance of competitive theories of wage determination - as opposed to alternative non-competitive explanations - as adequate explanations of the functioning of labour markets. In this respect, the line of research which will be used seems fruitful for two main reasons: firstly, it attempts to provide new evidence on the determinants of wage dispersion and on other wage phenomena; secondly, the use of micro-data may allow one to consider issues which have been mostly ignored by previous studies on Italian labour market.

The plan of the thesis is as follows. Chapter 2 is a survey of the relevant literature on wage determination both from the theoretical and empirical point of view. Initially, it considers the evolution of wage determination theories contrasting the implications of models couched in the traditional competitive paradigm with models that stress the relevance of non-competitive factors. More recent theoretical models considering wage bargaining practices, labour contracts, insider power and efficiency wages are reviewed next. The second part of the chapter surveys early and recent empirical evidence on cross section studies of wage determination. Since empirical evidence for Italy is limited to few studies, also U.S. and U.K. relevant studies are considered. The main findings which emerged from those studies are then discussed and compared across countries.

Chapter 3 considers the issue of inter-industry and occupational wage differentials in Italian manufacturing industries. While previous studies had extensively documented the existence of wage dispersion across sectors and

occupations using aggregate data, in this study the importance of industry affiliation on wage determination is evaluated after controlling for a wide range of personal and job characteristics. Although part of wage variation is explained by differences in educational attainments and working experience of individuals, a significant portion of wage dispersion can be attributed to the different pay policies of industries. The inter-industry wage structure proved to be relatively stable over time and fairly similar across different countries. Also the pattern of occupational differentials was found to be systematically correlated across industries. Although the chapter provides extensive evidence on the characteristics and magnitude of wage differentials, it does not directly address the issue of which are the causes of the observed pay differences. This is done in the following chapter.

Is wage dispersion dependent on different pay policies of firms, and are there any firm characteristics which are systematically correlated to wage differences? Chapter 4 investigates these issues using a matched sample of individual level data and firm characteristics. This merging of data sets allows an exploration of the impact of firms specific characteristics on wage determination, after controlling for relevant individual attributes. Firm's product market behaviour and its financial structure proved to be among the main determinants of wage differences. Firm profitability, in contrast with the view commonly held, was positively correlated with wage levels. Also market concentration appeared to influence firms' ability to pay.

A common finding of the studies discussed above is that male workers, *ceteris paribus*, are paid more than their female counterparts. Also the proportion of females employed in a firm is negatively correlated with wage levels. The issue of gender wage discrimination is considered in chapter 5. Separate earnings equations for males and females are estimated and a gender wage discrimination coefficient is calculated. Although pay differences among sexes, in the Italian manufacturing industry, are not of a considerable magnitude, nevertheless the size of the discrimination coefficient is found to increase with male occupational intensity.

Chapter 6 investigates the role of different components of pay on wage determination. The two-stage procedure for wage determination, which characterises the Italian system, is firstly described and then its effects estimated using two different data sources for the metal-mechanical industry. The theoretical framework is based on efficiency wage theory and a drift-effect model is developed. The first part of the chapter analyses the different impact that collectively negotiated wage levels and wage premia unilaterally paid by firms have on labour productivity. The study adopts the production function approach augmented for efficiency factors, using time series data for the period 1974-1985. A significant impact of wage drift premia on labour productivity is detected, and the hypothesis that firms use discretionary payments to boost productivity is proposed. The second part addresses the same issue in the context of relative wages. In other words, the purpose is to assess whether firms' pay policies are shaped to offset the pattern of collectively negotiated pay levels. This is done by matching a sample of individual level data on earnings with detailed information on pay composition. The main finding is that the pattern of wage levels which emerges from collective bargaining is modified but not completely undone by firms' discretionary payments.

In chapter 7 the features and the length of the attachment of workers to firms are considered. In particular, the study argues that the traditional "spot" labour market characterisation is difficult to reconcile with the existence of long term employment relationships. The relevance of job tenure for the employment relationship is tested using micro-data for Italian manufacturing industry. The empirical approach uses an appropriate methodology for the analysis of job duration, and separate job-tenure equations for white and blue collar equations are estimated. The probability of a job separation is positively influenced by higher educational attainments, but negatively correlated with previous job experience and with firm size. Also, given the wage, the probability of leaving the job increases with the length of the job spell.

Although the work undertaken in this thesis focuses on different issues, all the component studies share a common view on wage determination mechanisms and are

linked in a number of ways. The search for an adequate explanation of wage determination in Italy has offered a differentiated and often complex picture, which needs to be supported by further research on different data sets and for different time periods. In this light, chapter 8 presents some concluding remarks and discusses potential fruitful routes for future research.

CHAPTER TWO

Wage Determination: Theory and Evidence

The labour market plays a central role in both the stability and the growth of economic systems. This might be the reason why the search for a theory of wage determination has always been at the *core* of economic analysis. In attempting to provide an adequate explanation for the functioning of the labour market, economic theory developed several, and often competing, interpretations of the phenomena. On the other end, applied economists have tried to investigate the actual behaviour of the labour market and contrast it with the theoretical predictions.

The analysis of wage determination mechanisms and other labour market phenomena always stressed the existence of significant discrepancies between what was suggested in theory and what were the "observed facts". This chapter is by no means intended as a comprehensive survey of the literature on wage determination, rather the purpose is to present a selective review of the literature relevant for the work pursued here. After outlining the theoretical predictions of different models of wage determination, we shall consider the evidence presented by the empirical studies. As evidence for Italy is limited to few recent studies, we will also present evidence on U.S. and U.K. experience.

1. Theoretical Models

Although it is difficult to report exactly the different implications of the debate on wage determination theories, nevertheless it is possible to identify two main strands in the literature, namely: "market clearing" theories - in which the equilibrium coincides with full employment of factors of production - and "non-market clearing" theories - in which full employment is not necessarily achieved -. In the first case, the economic system is driven by market forces which, through the price mechanism and in the absence of distortions, always guarantee full employment. Conversely in the second case not only does full employment merely represent a particular case, but also there is no assurance that a mechanism which can drive the system towards that objective exists.

This controversy has remote origins in the economic literature and it is closely related to the old question of whether wage rates are determined by a classical competitive market. In the traditional analysis of labour market, as developed from Marshall onwards, the price of labour - as in any other market of the economic system - depends on the working of supply and demand. In his *Principles of Economics*, Marshall (1920) defined the mechanism in the following way:

> The nominal value of everything, whether it be a particular kind of labour or capital or anything else, rests, like the keystone of an arch, balanced in equilibrium between the contending pressures of its opposing sides; the forces of demand press on one side, and those of supply on the other.

In this view wages are perfectly flexible and deviations from full employment equilibrium are only transitory. Unemployment is explained by the existence of frictions, institutional rigidities and errors in expectations formation which prevent prices from reaching that level compatible with full employment (market clearing).

Keynesian analysis put into question this characterisation of the functioning of the labour market and of the causes of unemployment. Keynes (1936) suggested that

the main cause for the existence of unemployment laid in an insufficient level of aggregate demand. In other words, firms employ fewer workers because consumers buy fewer goods. Two main implications arise from this analysis, first the equilibrium does not necessarily coincide with full employment, and second there are no forces in the market which can drive the economic system to full employment (non-market clearing). Although the main cause of the existence of unemployment did not depend on the inflexibility of wages, Keynes also proposed an explanation for wage rigidity[1]. In particular, it is the presence of a rigid structure of wage differentials which prevents wages from being flexible. Workers have as a reference point some wage relativities, which exist among groups and across occupations and industries, and resist any attempt to change them. As stated by Keynes in the *General Theory*:

> ...any individual or group of individuals, who consent to a reduction of money-wages relatively to others, will suffer a *relative* reduction in real wages, which is a sufficient justification for them to resist it.

This is interesting, because in a decentralised wage-setting system, in which it is impossible to set simultaneously all wage rates, a reduction of individual money wages - not followed by an equal general reduction - implies a real loss with respect to alternative wages. Therefore, even in the presence of unemployment, wages will be inflexible downward.

The idea that the standard characterisation of an auction market does not accord with the working of labour markets has long been recognised by several economists. Sir J. Hicks in his *Theory of Wages* (1966) commented:

> The labour market is - by nature, and quite independently of Trade Union organization - a very special kind of market, a market which is likely to develop a "social" as well as purely economic aspects,
>
> ...the relation between the employer and at least a major part of his employees will be a continuing relation.

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[1] As suggested by Keynes, a reduction in money wages (if applicable) could generate a deflationary process which, in the end, would increase rather than decrease unemployment.

> ...For the purely economic correspondence between the wage paid to a particular worker and his value to the employer is not a sufficient condition of efficiency; it is also necessary that there should be no feelings of injustice about the relative treatment of different employees (since it would diminish the efficiency of the team), and there should be some confidence about fair treatment over time.

The simple recognition of the importance of these factors should cast some doubts on any mechanical interpretation of the functioning of labour markets and therefore on the limits of competitive models as applied to labour markets.

This has been actively discussed in the post-war period. On one side, some economists have continued to portray wage determination as a purely competitive process following the market clearing paradigm[2]. On the other side, others have become progressively uneasy with the traditional view of a competitive theory and have developed alternative approaches in the spirit of the non-market clearing paradigm[3].

No attempt will be made here to review the vast literature that in the past decades, following different routes, has tried to reshape views of the operation of labour markets; rather it is intended to sketch some of the major developments in the theory of wage determination[4].

Competitive Theories

Conventional theory suggests that under conditions of perfect competition in the product and factor markets an economy characterised by a homogeneous labour

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[2] Among the major contributions in this area we can consider the development of the concept of the "natural" rate of unemployment (Friedman, 1968). Keeping the hypothesis of perfect flexibility of wages and prices these models derive the existence of unemployment from misperceptions in expectations formation (over prices or interest rates), which cause unemployment to deviate from its "natural" rate.

[3] The so-called "fix-price disequilibrium" models derive unemployment outcomes assuming wage and price rigidity and showing how in such a world individuals are rationed in their optimal choices (Barro and Grossman, 1971; Malinvaud, 1977).

[4] As with any choice of taxonomy, there are cases in which the inclusion of a theory in a given classification may appear rather arbitrary. Having said this for sake of clarity we shall, nevertheless, use a simple classification.

force, costless information, costless search and homogeneous preferences of workers, will pay (in the long run) all the workers the same wage, fully employing all the factors of production. Although temporary differences in remuneration may still be observed as a result of sectoral demand shocks, in the long-run the flow of workers directed towards those industries and occupations paying high wages will eliminate all the wage gains. Under these hypotheses there is no reason why workers should have a particular attachment to a firm; they will continuously change job if there are, even temporary, gains to be made. The model can be easily extended to the case of heterogeneous jobs and heterogeneous labour; in this case, given perfect information, the equilibrium of the competitive model entails all workers with the same individual-job match characteristics obtaining the same wage.

Perhaps the most extensive effort in labour economics of the last two decades has been the formulation of the human capital theory (Mincer, 1958; Becker, 1975). According to the predictions of the theory, workers receive different wages depending on their endowment of education and work experience. In this view, the acquisition of either a degree or a particular professional skill represents a rational choice of the individual who forgoes potential present earnings for future benefits derived from a higher remuneration. Therefore wage differentials should be entirely explained by observable individual characteristics (i.e. the human capital). The existence of large inter-industry wage differentials, which are not easily explained by measured human capital attributes, constitute a problem for the consistency of the theory. Furthermore, if theories are to be assessed on their ability to explain the real world, the readily observable facts of unemployment, trade union activity and wage inflexibility are hard to reconcile with the statement that wages and prices, in relevant time periods, will clear the labour market.

Non-competitive Theories

Only quite recently, have attempts been made to formulate theoretical frameworks in which the existence of wage differentials, unemployment and wage rigidity is derived from an optimizing behaviour of workers, firms or trade unions. In the literature it is possible to identify four quite distinct frameworks of analysis, which under different assumptions give rise to wage differentials, unemployment and wage inflexibility:

i) implicit contract theory (Baily, 1974; Gordon, 1974; Azariadis, 1975);

ii) theories of union behaviour (Farber, 1986; McDonald and Solow, 1981; Oswald, 1985).

iii) insider-outsider theory (Lindbeck and Snower, 1986a,b; Solow, 1985);

iv) efficiency wage theory (Liebenstein, 1957; Stiglitz, 1976; Solow, 1979a);

The theory of implicit contracts, having as a main objective the explanation of unemployment and real wage rigidity, had the merit of viewing the employment relation as a long-term attachment between the firm and the employee. The main implication of the approach is that the wage does not bear a strict relation to the marginal revenue product of labour. The explanation for this result lies in the assumption concerning the relative risk aversion of firms and workers. In implicit contract models the wage is rigid because a risk-neutral firm provides income insurance to its risk-averse workers. However, a number of authors have criticized the main results on various grounds. First, the model can predict over-employment as well as under-employment (Akerlof and Miyazaki, 1980). Second, under slightly different assumptions the wage stickiness result disappears (Grossman and Hart, 1981). Further developments of the theory have focused on enforcement problems, moral hazard and reputational constraints, and asymmetric information. However, even in an asymmetric information world the wage inflexibility result does not always hold.

A second important contribution is concerned with models describing union behaviour in the wage setting process. These theoretical frameworks analyse bargaining practices between labour organizations and management associations over pay and employment (in some formulations also over non-wage issues, see: Johnson, 1986). This class of models, according to the assumptions made, can explain some particular features of negotiations, dispute resolutions and layoff practices; they generally predict wage rigidity and underemployment (but over-employment too) over the cycle[5]. The various models differ according to the assumptions made on the arguments of the union's utility function. In the so-called "monopoly union model" the trade union unilaterally set the wage level, while the firm chooses the level of employment on the demand curve (Dunlop, 1944). This model has been criticised on the ground that both the trade union and the firm could do better by jointly negotiating over wages and employment. In other words, bargaining over wages and employment leads to a Pareto superior outcome which lies on the contract curve (McDonald and Solow, 1981). This is often referred to as the "efficient bargain model". Finally, a third approach known as "right to manage model" suggests that the bargain occurs over the wage and that employment is then set by the employer. In this case the outcome of the bargain still lies on the labour demand curve, though the position depends on the parties' bargaining strengths (Nickell and Andrews, 1983)[6].

Insider-outsider theory starts off from the simple recognition that there is a substantial difference between workers employed in a firm (insiders) and those workers who are actively searching for a job (outsiders). The reason for this difference lies in the assumption that it is costly for a firm to replace an "insider" with an "outsider". The reasons why these costs arise are various: for example, to recruit and select workers takes time and significant resources, also specific skill endowments are not easily reproduced. The existence of this cost differential gives rise to insider power. In practice, insiders use their bargaining power to extract a share

[5] The level of employment will mostly depend on the slope of the contract curve.
[6] A particular case is given by the "seniority model" which predicts that bargaining outcomes both lie on the labour demand curve and are efficient (Oswald, 1985).

of any surplus profit and set the wage at higher level with respect to the competitive wage. The difference is smaller or equal to potential turnover costs (Lindbeck and Snower, 1986b). In this way insider-outsider theory provides an explanation for the existence of wage differentials and unemployment.

Although the class of models grouped under the "efficiency wage" hypothesis differ substantially with respect to the emphasis they place on various labour market features, they nonetheless all share the property that over an economically relevant portion of output levels, wage increases might raise firm profitability[7]. There are a number of reasons why output might depend on the wage paid: high wages may increase morale and therefore the productivity of the individual worker (or of the team), they can lower turnover costs reducing quits, deter shirking or attract workers with higher unobserved quality. Furthermore, as reductions in pay may adversely affect the behaviour of employees, wages will be mostly inflexible over the business cycle. The theoretical implications of the different models are discussed next.

In the "shirking model" the hypothesis is advanced that in most production processes, supervision and monitoring of workers are often expensive to operate or impracticable (i.e. for example if workers are organized in teams). Under these conditions, employers might find it profitable to pay a wage above the opportunity cost of workers in order to elicit adequate effort from their employees. Shapiro and Stiglitz (1984) and Bulow and Summers (1986), develop models in which the need of firms to extract effort from their workers can lead to the payment of wages in excess of market clearing levels and as a result generate unemployment. The implications of the shirking model is that similar workers will receive different wages according to the cost of monitoring incurred by the firm or by the industry. Moreover, the segmentation of the labour market into "primary" and "secondary" sectors will depend on the importance that shirking considerations assumed in the production process[8].

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[7] This is in clear contradiction with the standard competitive result that the derivative of the profit function, with respect to the wage, is equal to the negative of employment (Hotelling's lemma) and that it is always profitable to lower wages if it is possible to do so.

[8] For a definition of "primary" and "secondary" sectors, see: Doeringer and Piore (1971).

Where the characteristics of the production process require particular effort or high responsibility and a long-term attachment of the employee to the firm, then a primary sector with high wages and an internal labour market structure will be observed. Conversely, a secondary sector that offers low pay and no advancement prospects is more likely to be observed where these considerations are unimportant (Dickens and Lang, 1985)[9].

The "turnover model" posits that when firms bear part of the hiring and firing costs and the provision of training is also costly, payment of wages in excess of the market-clearing level can reduce costly labour turnover (Salop, 1979; Stiglitz, 1985). In general, workers will be more reluctant to quit the higher the relative wage paid by the firm and the worse the prospects in the external labour market.

The "adverse selection model" takes into account the existence of asymmetries of information in the labour market. Under these conditions the payment of efficiency wages may provide an optimal selection criterion. If workers are heterogeneous in ability, and if ability and reservation wages are positively correlated, a firm with higher wages will attract higher quality candidates (Weiss, 1980).

A further justification for the payment of efficiency wages results from the recognition that an individual's effort or productivity might bear a positive relationship to his/her perception of a fair treatment. As suggested by "sociological models", higher wages can increase morale and feelings of loyalty towards the firm (Akerlof, 1982, 1984; Solow, 1979b). This class of models provide some rationale for the existence of internal labour markets and rigid wage structures (Doeringer and Piore, 1971).

In conclusion, "non-competitive" theories seem able to provide a rationale for several stylised facts of the labour market. In addition to involuntary unemployment and wage stickiness, "non-competitive" theories can explain, among others, labour

[9] Some authors (Carmichael, 1985), have argued that the payment of efficiency wages is sub-optimal as shirking can be avoided by simply asking workers to post a bond against cheating. Dickens, Katz and Lang (1986) have shown how the "bonding critique" is only applicable under very restrictive conditions.

market segmentation, wage differences for workers of identical characteristics, discrimination, layoff practices, long term employer-worker attachment, and the existence of "internal" labour markets.

2. Empirical Evidence

In this section a review of the empirical work on the determinants of wages is presented. In doing so, it should be noted that the empirical literature has evolved over time along two quite distinct lines of research: one based upon cross-section evidence, the other based on aggregate time series analysis. The former originates from the work of a number of U.S. institutional economists who were interested in the causes of wage dispersion and on the evolution of the wage structure (Slichter, 1950; Lester, 1952; Reder, 1962). The second stems from the early empirical work on the wage/inflation-unemployment tradeoff, better known as the Phillips' curve (Phillips, 1957). Thesetwo strands in the literature evolved over the last four decades almost independently on parallel channels. Despite the relevance of aggregate time series studies for a better understanding of wage determination mechanisms, for the purposes of the present work we shall restrict our attention only to cross sectional evidence.

Early Empirical Evidence

In his seminal work on the structure of wages in the U.S. Sumner Slichter suggested that:

> Neither wage rates nor hourly earnings represent the price of labour - that is, the amount which the employer pays for a given amount and kind of service or the amount which employees receive for doing a given kind of work under given conditions.

He reached this conclusion after examining the average hourly rate of skilled and unskilled male workers in 20 U.S. manufacturing industry between 1923 and 1946. The wide variation both in the rates paid by different plants within the same locality for similar jobs revealed to be extremely stable over long time span. In other words, "high" and "low" wage industries seem to maintain their features over time. He suggested that the main determinants of "high" wages were: high skill levels, a low proportion of women, high value added per worker, high value product of labour, low payroll costs as a proportion of sales revenue, and a high ratio of net income after taxes over sales. Managerial discretion over pay levels was advanced as main explanation for the observed differences. This evidence was in clear contradiction with the standard competitive view of the functioning of labour markets. Further work by Lester (1952) and Reder (1962), among others, confirmed Slichter's findings. A later British study by MacKay *et al.* (1971) focussed on similar issues. After examining the personnel records of 75,000 manual workers in 66 engineering plants, the authors found significant differences in pay which could not be easily reconciled with standard competitive explanations. Their main conclusion was that workers are able to extract a share of firms' product market rents.

A comprehensive study for the Italian manufacturing sector is represented by Dell'Aringa (1976). The author used different data sources on average industry and occupational earnings for skilled and unskilled manual workers between 1950 and 1975. A wide dispersion in average earnings was reported across industries for similar types of jobs and, within each industry, among firms of different sizes. Given the relevant role played by trade unions in wage determination in Italy particular attention was given to collective agreements. While negotiated wage levels had the effect of compressing wage differentials across industries and occupations; overpayments, through the wage drift mechanism, had the opposite effect and increased wage dispersion. The effect was found to be more pronounced in those industries where "ability to pay" was higher.

In conclusion, a common pattern of findings emerge from these early studies on wage determination: first, a significant dispersion of wages across industries and occupations; second, a relative stability over time of the observed differences; and third, the existence of an implicit rent sharing mechanism originating from firms' ability to pay. We turn now to more recent empirical evidence.

Recent Econometric Evidence

Over the last decade there has been a revival of interest in cross section studies concerned with the empirical validation of wage determination theories. The majority of the work on this topic has been based on U.S. data. Only very recently an increasing number of studies have attempted to replicate the results for several Western European countries. As noted by Carruth and Oswald (1989) there are at least two reasons which can explain the phenomenon: first, the availability for research purposes of large data sets suited for this kind of analysis; second, the increasing availability of computers capable of handling such data. The same reasons can be put forward to explain why in some countries (such as Italy) research is still limited to a few studies. Indeed the data requirements for the investigation of the determinants of wages are quite demanding. On one side, the complexity of wage determination mechanisms requires a large number of variables not only on the characteristics of the workers involved and their condition of work within the firm, but also on general labour market conditions. Since data sets are usually drawn from either household surveys or establishment (or firm) surveys, the two types of information are typically not simultaneously available. On the other side, given the heterogeneous nature of factors of production, a great deal of information at a highly disaggregated level is required. Last but not least, a correct measure of individual earnings (on hourly, monthly or annual basis) and their composition (basic rates, bonuses, overtime, non-pecuniary benefits, etc.) should be available.

The basic empirical methodology for analysing wage determination mechanisms using cross section data has relied mainly on the estimation of earnings equations. Although earnings equations are widely used in the literature often without any reference to their theoretical underpinnings, nevertheless it is possible by this method to derive a relationship between the level of earnings and a set of explanatory variables which start from different, and often observationally equivalent, theoretical models. The rationale for the introduction of individual characteristics among the regressors in an earnings equation can be derived from standard human capital theory. The latter is usually amended by the introduction of additional vectors of variables which in various ways influence wage levels. However, it should be said that according to the standard human capital theory variation in earnings should be entirely explained by observed personal characteristics and additional variables should play no role. Further extensions of the standard model have focussed on the role of "unobserved" characteristics and on non-wage attributes that affect the utility of individuals. The latter arguments provide further reasons for the inclusion of additional control variables in the specification of earnings equations.

Wage bargaining theories, insider power and efficiency wage models provide further theoretical justifications for the estimation of wage equations. The way of discriminating among the competing models rests with the inclusion of additional explanatory variables, and both on their signs and statistical significance. However, in this case, since the empirical specification is derived from either a firm's profit maximisation problem or a Nash bargaining approach the object of investigation is shifted from the individual worker to the establishment or the firm. Also the level of disaggregation of the data used in the estimation change accordingly.

The approach is best illustrated in the following way:

$$w_{ij} = \alpha + X'_{ij}\beta + Y'_{j}\gamma + Z'_{ij}\delta + e_{ij} \qquad [1]$$

where w_{ij} is a measure of earnings for the i-th individual (if establishment level data are used the subscript i refers to the plant), employed in the j-th industry or occupation (or a combination of the two); X_{ij} is a vector of personal characteristics (or average characteristics if establishment level data are used); Y_j is a vector of industry or occupational attributes; and finally Z_{ij} is a vector of other variables affecting earnings. As usual, α is the intercept and β, γ, δ are parameter vectors, e_{ij} is the stochastic error term. Although, equation [1] has been specified in a linear form, there are no particular reasons for this to be the case and both interaction terms and non-linear terms can appear on the right hand side. Equation [1] can be easily extended to the case of panel data adding a subscript t so as to indicate time-varing characteristics. The earnings function approach is adopted by most studies as the starting point for the analysis of the determinants of wages.

A number of U.S. studies have recently re-examined the evidence on wage structure using an augmented human capital approach. Katz (1987), Dickens and Katz (1987a,b), and Krueger and Summers (1987) provide a wide range of evidence on the magnitude, intertemporal stability and structure of industry wage differences. Using both historical data on average industry earnings and a large cross section on individual earnings (U.S. - Current Population Survey - CPS data), they present new evidence on the nature and the importance of inter-industry wage differentials - both in the union and non-union sectors - for different occupations. Their main conclusion is that the large industry wage differences detected in the empirical analysis cannot be explained by observed human capital, demographic, or locational variables. All the studies control for a large number of personal characteristics and job attributes. No evidence is found for the hypothesis that wage differentials represent a compensation for undesirable job attributes that affect the utility of workers.

Krueger and Summers (1988), Gibbons and Katz (1989) and Murphy and Topel (1987) use longitudinal data to estimate first-difference (or fixed-effects) regressions. The hypothesis under investigation is whether wage differences could be ascribed to unobserved ability being correlated with industry affiliation. After

controlling for time-invariant characteristics they conclude that the evidence emerging from cross sectional and longitudinal studies is very similar.

Dickens and Katz (1987b) investigate further the nature of wage differences matching CPS data with a large number of industry characteristics. Their findings suggest that both product market power and financial performance of the employer are among the main determinants of wages. The authors argue that three variables stand out - from the literature survey and their own analysis - as having a consistent relation with wages, namely: average years of education, profitability and both size of establishments and capital-to-labour ratios[10].

Using data on the number of job applicants per opening and starting wages for a large sample of employers, Holzer, Katz, and Krueger (1990) find a positive relationship between industry wage differentials and the number of job applicants, even after controlling for detailed job characteristics. They conclude that, *ceteris paribus*, high-wage industries are characterised by longer job queues per opening than are low-wage industries.

Finally, Katz and Summers (1989) consider the implication of industry rents, of the type so far described, for strategic trade policies. They suggest, after presenting convincing evidence on industry rents and trade patterns, that when competitive forces do not equalise wages in different sectors the resulting allocative inefficiency can be offset by appropriate trade policies that raise employment in high-wage sectors.

It should not be surprising to find out that the emphasis placed in British studies on the structure of earnings is somehow different from U.S. comparable evidence. This can be explained partly by the considerable institutional differences existing between the two countries. Given the extent of unionisation and the relevance of collective agreements, British studies have concentrated more on the effects of unions on pay and on the estimation of union/non-union wage differentials. In

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[10] Both Krueger and Summers (1987) and Dickens and Katz (1987b) present an extensive survey of U.S. studies on wage determination using cross section data at different level of disaggregation.

general. British studies have used industry or establishment level data which in some cases might suffer from several drawbacks as they do not provide adequate controls for personal and job attributes[11].

One early study by Ball and Skeoch (1981) examines plant level data on wages in 15 manufacturing industries. Their results suggest that there is considerable variation in earnings across industries. They also detect a significant impact of value added per worker on wages, but reject (though without testing it) the possibility that more skilled workers are employed in high-wage plants. In the light of the results obtained they conclude that competitive theory does not represent a convincing explanation of wage determination mechanisms.

Stewart (1983) and Shah (1984) used individual level data to estimate separate earnings equations for union and non-union workers. Their results suggest that workers in the union sector of the economy earn more than they would if they worked in the non-union sector. Similar results, on different data sets, are presented in Blanchflower (1984) and Stewart (1987, 1990). In the latter study, differentials are found to be very different in establishment facing competitive product market conditions as opposed to those in establishmentswith some degree of product market power. In other words, as already suggested by U.S. evidence, the existence of monopoly power in the product market represents the main source of the rents which unions are able to extract.

Another study by Blanchflower, Oswald and Garret (1988) addresses the issue of insider power in wage determination using the Workplace Industrial Relation Surveys (WIRS). They propose an encompassing theoretical framework for different wage determination models and estimate a wage equation using data drawn from a sample of 2,019 establishments. Their main conclusion is that classical competitive theory does not provide an adequate explanation of wage determination in Great

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[11] The evidence presented in Geroski and Stewart (1986), concerning the magnitude of the union/non-union wage differential in British studies, suggests that problems such as aggregation bias and inadequate controls for relevant characteristics tend to over estimate the true wage differential when aggregate data are used.

Britain. Pay levels are shaped by an intricate blend of internal and external forces and for all but unskilled non-union workers a model based on the distinction between insiders and outsiders, where unions and bargaining play a central role, may represent a better framework of analysis. In their words, wage determination may be seen as a kind of rent sharing in which workers appropriate a portion of profits, and in which external forces affect workers' bargaining strength. On a similar data set Haskel and Martin (1990) investigate the determinants of wages using the augmented human capital approach. They estimate separate earnings functions for unionised and non-unionised workers. The analysis concentrates mainly on the inter-industry wage structure and on the determinants of the industry wage premia. A significant effect of industry affiliation on wages is detected both in the union and in the non-union equation. Among the main determinants of industry premia, the authors suggest that average plant productivity and product market power play a relevant role; furthermore, the effect appears to be more pronounced in the non-union sector. In order to check whether competitive explanations of wage determination could provide an adequate representation of some segments of the labour market, the authors analysed the market for unskilled non-unionised workers. Although the latter can be considered - on several grounds - close to a competitive labour market, the main findings led to a rejection of standard competitive theory, conversely efficiency wage and rent-sharing models were preferred instead. However, it should be noted that the study has several drawbacks and results should only be taken as a preliminary evidence. In particular, the use of establishment level data and the lack of relevant control variables make the data set used in the study not appropriate for this kind of analysis.

Finally, Nickell and Kong (1988), and Nickell and Wadhwani (1989) use panel data to investigate the role of insider forces in wage determination. They find a significant impact of insider forces on pay, in particular own prices and productivity have a strong effect at the firm level. The relationship between the impact of insider effects and union power is somewhat ambiguous. In Nickell and Kong, the insider

effect is systematically related to union power across industries. Conversely, Nickell and Wadhwani find that insider effects are systematically inversely related to the extent to which firms take account of national industry wage agreements in their wage bargaining activities. They also detect a role for outside factors, as captured by aggregate unemployment and long term unemployment, in wage determination. Similar results were obtained by Gregory, Lobban and Thomson (1987) using panel data from the CBI's Databank Survey of Pay Settlements.

The main weakness of the empirical evidence available for Italy is that only few cross section studies based on small and fairly unrepresentative data sets exist. The lack of adequate data sets is a serious problem and so far has severely affected research on these issues. An early study by Antonelli (1985, 1987) investigates the relevance of the human capital approach using a sample of individual level data for one Italian region (Emilia Romagna). The author estimates several earnings equations mainly focussing on returns to education and labour experience. Separate regressions are fitted for private and public sectors of the economy. The analysis of age-earnings profiles in the private and in the public sector reveals different patterns of behaviour. In particular, starting wages appear to be higher in the public sector but wages rise faster in the private sector. The main finding is that standard human capital theory explains only a small part of the variation in earnings and therefore - as the author concludes - it represents an insufficient framework for the analysis of wage determination.

Sestito (1988) uses industry level data to investigate the relevance of north-south wage differentials. In order to net out the industry effect on regional wages, a fixed-effect model is estimated and several control variables are included. A negative effect is detected on the localisation dummy, meaning that southern workers, *ceteris paribus*, receive lower wages. The effect, however, is reduced when large size firms are considered.

An explicit analysis of inter-industry and occupational differentials is contained in Lucifora (1989). The study uses individual data for the metropolitan area

of Milan. An augmented human capital approach is adopted and several earnings equations are estimated. The role of both industry affiliation and firm size in explaining earnings variation is confirmed by the results. However, given the local nature of the survey, results cannot be extended to the rest of the economy.

A more comprehensive study is the one by Cannari, Pellegrino and Sestito (1989). The authors use a nationally representative sample of individual level data drawn from the Bank of Italy Household Survey (BIHS). The analysis contains a careful investigation of the data and an accurate functional form search. Several augmented human capital earnings functions including industry, occupational and localisation controls are estimated. The analysis confirms some of the findings of U.S. and U.K. studies. Industry controls explain a relevant portion of log wage variation; also coefficient estimates suggest a wide variation of earnings across industries even after controlling for relevant personal characteristics. However, given the lack of adequate control variables for job attributes, working conditions, firm characteristics and product market conditions - common to most data sets drawn from household surveys -, the latter results should be considered more as a descriptive evidence on inter-industry wage differentials than as an attempt to discriminate among competing theories of wage determination. A recent study by Sestito (1990) investigates cross section evidence on wage determination over the last decade. Using several streams of BIHS data, for the period 1977-87, the author estimates separate earnings equations for each year. The cross years comparison suggest that no significant changes in earnings' inequality occurred in the period under investigation. The structure of wages remained relatively stable over the years, both in terms of human capital attributes and industry characteristics.

At the time of writing, there are no contemporary Italian studies which have tried to investigate using cross section evidence the role of job attributes, firm characteristics, and product market conditions on wage determination. Although available evidence on U.S. and U.K. labour markets suggests that competitive theories of wage determination do not represent an adequate explanation for the functioning of

labour markets, in Italy the lack of adequate data sets has not allowed similar research to be carried out. Since the question whether the labour market is driven by competitive forces is a relevant one, both on welfare grounds and as far as policy prescriptions are concerned, it appears useful to address these issues in the light of the Italian experience using adequate data sets. This will be done in the following chapters.

CHAPTER THREE

Inter-industry and Occupational Wage Differentials

1. Introduction

The existence of significant differences in wages across industries and occupations has generated interest among labour economists and industrial relations specialists for a long time. The vast literature on wage determination of the post-war era, extensively documented the existence of large and persistence wage differentials among industries and workers of comparable skills.

This strand of research was gradually forgotten in the following decades, and only recently a renewed interest in these aspects of wage determination has stimulated further work. Indeed, the main reason for this revival of interest in studies of the wage structure, may be related to the increasing availability of new micro-data sets containing a great deal of information on personal and market characteristics. Hence, researchers have been able to examine rigourously the new evidence on wage determination using adequate econometric methods.

The purpose of this chapter is to provide extensive evidence on the characteristics of the wage structure in the Italian manufacturing industry, focussing on the behaviour of wage differentials among industries and occupations[1]. The

[1] Further aspects of the wage structure will be considered in the following chapters.

approach to be adopted is to empirically examine the influence of industry and occupational affiliation on the level of pay, and to get some insights on the forces which drive the wage determination process. There are, at least, two main reasons why this kind of investigation might prove interesting. The first, and more obvious, is that very little empirical work on these issues has been done for the Italian economy, and existing work generally suffers from severe data deficiencies. The second, and more fundamental, is concerned with the high degree of pay inequality experienced by Italy - as reported both by international comparison studies (see, Saunders and Marsden, 1981), and by parliamentary commissions explicitly created to investigate the problem ("Commissione Coppo", 1976; "Commissione Carniti", 1988).

The structure of the chapter is as follows. The next section presents some preliminary evidence on the stability of the inter-industry wage structure. Section 3, surveys some of the main theoretical arguments advanced in the economic literature to explain the existence of wage dispersion. In section 4, we describe the data set used and its major drawbacks. Section 5, outlines the methodology employed and presents empirical evidence on the wage structure in the Italian manufacturing industry. Section 5.1 looks at the inter-industry wage differentials, while section 5.2 analyses the occupational structure of industry wage differentials. The main implications of the theory are discussed therein. Section 6 investigates the robustness of the main findings. A summary and some concluding remarks are contained in the last section.

2. The Wage Structure: Some Preliminary Evidence

> Wage theory must operate with the concept of *wage structure*... the task of analysing wage determination is not the problem of setting a single rate but rather the problem of setting and variation in the whole structure of complex of rates.
>
> (Dunlop, 1957)

The concept of wage structure for the analysis of wage determination represented a central issue for the economists of the post-war era. Their concern for the analysis of wage differentials - however considered, ie. by industry, occupation, area, etc. - may be interpreted as an implicit disbelief that observed differences could simply be the outcome of the operating of market forces. In fact, from the standard competitive point of view, there should be no reason for giving so much emphasis to pay differences, for factor prices are equalised across areas, industries and occupations and all workers are compensated according to their opportunity cost. It is the alleged existence of imperfections in the market mechanism which makes the analysis of the wage structure relevant to explain the functioning of the labour market.

Most of the early work on the wage structure focussed on the differences in pay levels for (almost) equally skilled workers across industries, and on their persistence over time. The work of Slichter (1950), represents one of the first attempts to provide extensive empirical evidence on the wage structure. In the analysis of the average hourly wage rates of skilled and unskilled male workers, in 20 manufacturing industries for the US, he reported the existence of large industry differences in pay, and showed their stability over time. In the same study the rank correlation of average industry earnings, between 1923 and 1946, resulted equal to 0.73. He also suggested the existence of certain "regularities" in the wage structure: for example, the pattern of industry wage differentials appeared to be quite similar between skilled and unskilled workers, and positively correlated with average (labour) productivity and profit margins. On the basis of this evidence, Slichter concluded that "managerial policies" did play a relevant role in shaping pay levels. Many other similar works, for different periods and different countries, confirmed most of Slichter'jresults (Cullen, 1956; Reder, 1962; Lester, 1952)[2].

The finding that the pattern of wage differentials is remarkably similar, both over time and across different countries, seems to suggest that "high" and "low" wage

[2] An extensive review of early works on the wage structure both for the US and the UK is contained in Carruth and Oswald (1989). Dell'Aringa (1976), using aggregate data for the Italian economy, reports large industry and skill wage differentials. More recent evidence, for Italy, is contained in Asap (1986).

industries not only maintain their features over long period of time, but also exhibit similar characteristics in different institutional settings.

Krueger and Summers (1987), extended Slichter's analysis so as to consider the structure of wages in different time periods and across various countries. Analysing historical US data, they find that the correlation of industry wage differentials for 20 manufacturing industries, between 1923 and 1984, is equal to 0.56. Also, they show that the pattern of relative wages in 1982 (among manufacturing industries) is similar across 14 different countries: the matrix of bivariate correlations, for most of the countries considered, reports values ranging from 0.6 to 0.95[3].

In the light of the above findings, it might be interesting to analyse the stability of the wage structure for the Italian manufacturing industry, and to compare the results with similar data for the US and the UK[4]. Figures 1, 2 and 3 present plots of the pattern of industry wage differentials between two different time periods[5]. Although the years considered differ across countries, nevertheless all the plots show that relatively "high" wages (and "low" wages) industries in the first period, still occupy the same position in the second period[6]. Furthermore, a direct comparison of the pattern of relative wages among the countries reveals a very similar structure, -ie. the rank correlation of average industry wage differentials of Italy, respectively with UK and US is 0.78 (IT vs. UK) and 0.86 (IT vs. US).

Summarising, the following conclusions may be drawn: first, it appears that the structure of relative industry wages hardly changes over time; second, there seems

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[3] Similar results were obtained when 1973 data were used.

[4] Some qualifications for the attribute stable, as it is used here, are in order. The concept of stability we use for the wage structure refers only to the ranking of industries according to the size of wage differentials, but nothing is said concerning the expansion (or contraction) of the differences themselves.

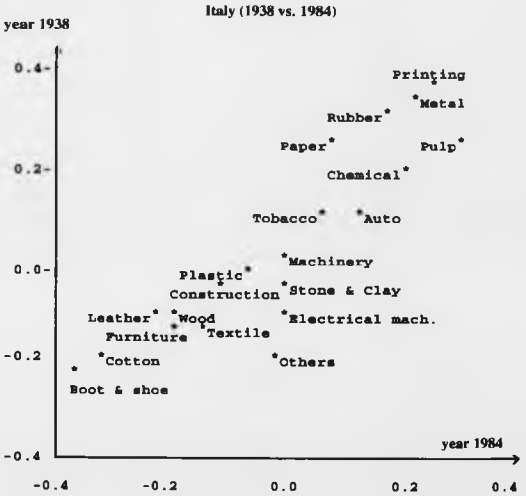
[5] In figures 1, 2, and 3 wage differentials have been defined as proportional difference from the average industrial wage.

[6] Strong stability is also evident for more recent time periods. The rank correlation of industry wage differentials, between 1974 and 1984, is equal to 0.97 for Italy; to 0.91 for the US (Krueger and Summers, 1987); and to 0.89 for the UK (Haskel and Martin, 1990).

to be no clear tendency for the industry wage structure to increase or decrease in the long run.

Figure 1. Wage Differentials Over Time

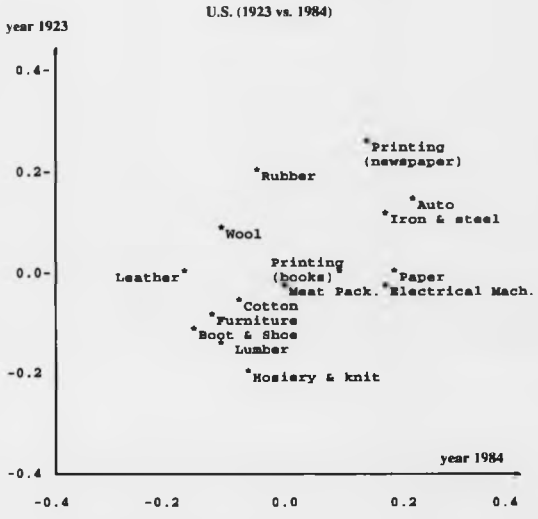
(proportional difference from mean wage)



(source: Ministero del Lavoro)

Figure 2. Wage Differentials Over Time

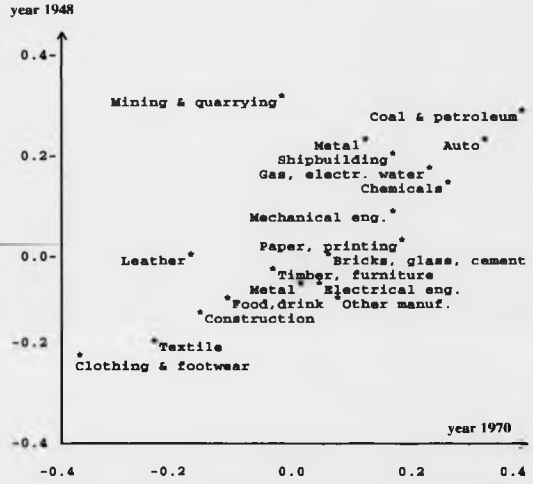
(proportional difference from mean wage)



(source: Krueger and Summers, 1987)

Figure 3. Wage Differentials Over Time

(proportional difference from mean wage)



(source: Haskel and Martin, 1990)

This is consistent with numerous studies which have argued that the wage structure (by industry or skill) does not exhibit any particular trend in the very long run, although its dispersion may vary in the short run as a consequence of the business cycle or other institutional factors (Lawson, 1982; Lewis, 1963)[7]. These results are quite interesting as they seem to rule out any explanation, for the existence of wage differentials, which relies on temporary disequilibrium phenomena, such as: market imperfections, or sluggishness in factor mobility.

If the wage structure is relatively stable over time and shows similar patterns across countries, it might prove interesting to analyse which are the main attributes of "high" paying and "low" paying industries. However, a major drawback of the above analysis is that it fails to adequately take into account the existing differences among various types of workers. The distribution of skills and other characteristics, relative both to workers and to jobs, are likely to influence substantially the wage paid by firms. Hence, any definite conclusion drawn from this mode of analysis can be highly misleading, if labour quality and/or working conditions vary significantly across industries and occupations.

In what follows, we shall analyse the main features of the wage structure according careful attention both to the characteristics of the labour force employed and to job attributes. Our approach will be to compare the inter-industry wage structure, as it results from simple average industry wages, with the estimated wage structure after controlling for a wide range of personal and job characteristics. The next section surveys some of the explanations often advanced to explain the existence of wage differences across industries and occupations.

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[7] For example, inter-industry (and skill) wage dispersion was greatly reduced in the 70s, in Italy and in other European countries, by the operation of institutional forces. However, in the 80s this process came to an end and differentials widened again towards their previous levels (Asap, 1986).

3. Explanations of Wage Dispersion: Some Theory

The existence of wage dispersion, *per se*, does not represent a problem for economic efficiency or for an optimal allocation of resources. There are several reasons why some workers, employed in a particular industry, might be paid more than similar workers employed in a different industry. We review them in turn.

3.1 Competitive Explanations

According to the competitive textbook explanation each worker should receive a compensation equal to his (or her) opportunity cost. The latter would be determined by the accumulated human capital and by job attributes. In this case, wage differences should simply reflect the existence of different labour skills, or, alternatively, they may indicate the presence of non-pecuniary aspects of jobs which affect the utility of the individual and need to be adequately compensated.

Labour Quality - Differences in production technologies or in the organisation of labour may often require the employment of more skilled workers. If this is the case, similar workers of a given skill should be paid the same in different industries, and industry wage differentials should simply reflect differences in labour quality. However, it has been argued that worker's productive ability might be imperfectly measured and that some unobserved (to the researcher) quality is responsible for the observed differences in pay. Although this criticism has some validity and unobserved quality differences certainly account for a significant part of the variation in wages, nevertheless it is more problematic to see why they should be systematically correlated with industry status. Several authors, in an attempt to deal with this problem, have used longitudinal data and have controlled for time-invariant unmeasured labour quality.

In fact, if high-wage industries merely employ workers with high unobserved ability and workers of a given quality receive the same wage in different industries, then wage changes should not be closely associated with changes in industry status. Krueger and Summers (1988), and Gibbons and Katz (1989) analyse the wage effects on a sample of individuals as they switch industry, using a fixed-effects model[8]. In both studies the estimated industry effects, from the fixed-effect regression, are similar in sign and magnitude to the industry differentials estimated in cross-sectional regressions.

Murphy and Topel (1987), using a different methodology, find that the industry effects of job switchers are significantly smaller than the cross-sectional evidence[9]. Although the evidence is not conclusive, it seems unlikely that unmeasured labour quality can entirely explain inter-industry wage differentials.

Compensating Differentials - A second competitive explanation for wage differentials considers, as a source of industry wage dispersion, the existence of compensating premia for non-pecuniary job attributes that directly affect the utility of workers. In other words, the idea underlying this hypothesis is that pleasant and unpleasant job attributes vary systematically across industries and require adequate (equalising) compensation for the conditions of work[10]. However, existing evidence suggests that inter-industry wage differences are not comfortably explained by compensating differentials. If job attributes do play a relevant role in determining inter-industry wage dispersion, then controlling for different working conditions should, at least, alter somehow the pattern of estimated differentials. Krueger and Summers (1988), find that the inclusion of several working condition controls barely affect the extent of

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[8] Fixed-effect estimation allows us to eliminate the impact of unchanging and unobservable labour quality (which is rewarded equally in all industries) on the industry wage effect estimates.

[9] There are several potential selection problems involved in studying the behaviour of individuals who voluntarily change industry. Gibbons and Katz (1989), discuss the issue and propose a methodology of analysis.

[10] See Brown (1980), and Rosen (1986) for a survey of compensating wage differential theories.

inter-industry wage variation[11]. One argument against this evidence is that wage rates represent only a portion of the total compensation package. Freeman (1981) and Krueger and Summers (1988) have shown that taking into consideration non-wage compensation (ie. fringe benefits) tend to exacerbate, rather than reduce, the estimated differences in industry compensation. Moreover, the strong correlation in inter-industry wage premia across occupations is hard to reconcile with the equalising differences hypothesis, since it is unlikely that the same unpleasant conditions of work which apply to production workers should somehow affect administrative or clerical workers. Further evidence suggests that industry premia are negatively correlated to quit rates (Krueger and Summers, 1988; Katz and Summers, 1989), and that high-wage industries attract a greater number of job applicants (Holzer, Katz and Krueger, 1990).

If anything can be inferred from the evidence presented here, this would suggests that inter-industry differentials reflect rents to good job, or to good worker-job matches, and seem to "add up" rather than "compensate" for given working conditions.

3.2 Non-Competitive Explanations

The evidence surveyed in the previous section seem to cast some doubts on the ability of standard competitive explanations to account for the observed pattern of wage differentials. If this is the case, then it might prove useful to survey some alternative interpretations for the existence of differences in pay levels, which allow departures from the standard competitive paradigm. In other words, it has to be explained why some high-wage industries, and firms, might find it profitable to pay

[11] Job attributes considered were: hours of work, health hazard of tasks performed, commuting time, extent of supervision, and several physical pleasantness of working conditions.
characteristics

above market clearing wages, or alternatively which are the impediments that prevent the payment of market-clearing wages.

Efficiency Wages - The growing literature on efficiency wages provides a useful reference framework for the analysis of wage differentials. The common feature of most efficiency wage theories is that, under certain conditions, increases in wages can raise the profits of the firm. According to the general hypothesis, if efficiency wage considerations are important, wage increases will have a less than proportionate impact on firm's costs as a result of the favourable impact on productivity. The rationale for the payment of non-competitive wages can be found in the need to elicit worker's effort and prevent shirking (Shapiro and Stiglitz, 1984), reduce turnover costs (Stiglitz, 1985), improve workers' morale and group cooperation (Akerlof, 1982, 1984), and, finally, attract a higher quality pool of applicants (Weiss, 1980)[12].

However, if all firms were identical, there should be no reason for observing differences in pay levels, even when efficiency wage considerations are important. Indeed, differences in firms' capacity to monitor, motivate, retain and recruit workers set the conditions for the payment of different optimal wage levels[13]. It should also be clear that under these circumstances similar workers can receive, over long periods, different wages in different industries, even when there is an excess supply of labour.

Each version of the efficiency wage hypothesis suggests, as its main implication, that industry (or firm) characteristics should be correlated with industry (or firm) wage levels. Therefore, monitoring conditions, turnover costs and firm size, among others, provide potential important factors for the payment of efficiency wages[14].

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[12] A more detailed discussion of the implications of each model is presented in chapter 2.
[13] Clearly, the existence of a different ability in monitoring, retaining, etc. activities can be related to firms (or industry) production technology.
[14] Katz (1987) and Krueger and Summers (1987), among others, present extensive evidence in support of the efficiency wage hypotheis.

Insider Power - Recent developments in insider-outsider theories provide an alternative, though not mutually exclusive, explanation for the existence of wage differences across industries and occupations. The central feature of these models can be identified either in the possession of a costly skill (specific capital), or in a particular status of the worker (insider, senior worker) which is the basis for insider power[15]. In other words, workers who cannot be quickly and costlessly replaced (in force of their skill or of their status) are able to extract rents from the firm (Blanchard and Summers, 1987).

Lindbeck and Snower (1986a,b, 1990) develop a model in which insiders - identified as those incumbent employees whose positions are protected by substantial turnover costs - share economic rents with the firm. As in the efficiency wage hypothesis differing production technologies across industries may give rise to differences in wage levels. In a similar way, Carruth and Oswald (1987), Nickell and Wadhwani (1989), and Blanchflower *et al.* (1988) provide empirical evidence for the existence of industry wage differentials and for the importance of insider factors. Their findings suggest that internal forces, such as workers' average skill, average productivity and profitability are relevant factors in shaping pay levels. As implied by the insider-outsider hypothesis, they found no evidence of insider power for unskilled workers.

Union Threat - One way workers may be able to raise wages above the market-clearing level is through collective action[16]. Institutional economists have long been stressing the importance of unions in wage determination[17]. The question is whether inter-industry wage differences can be explained by the pattern of unionisation across industries. Although traditionally industry wage differentials have been attributed to

[15] Clearly, in the case of union bargaining models the rent-extracting process involves all the workers, member of the union, as a group.

[16] Collective action can take the form of threat of strike, work-to-rule measures or different collective sanctions.

[17] Dunlop (1944), is a classic work on the impact of unions on wage determination. More recent works which contain an up-to-date review of the theoretical and empirical literature are, Freeman and Medoff (1984) and Hirsch and Addison (1987).

union behaviour and to the effects of collective bargaining, nevertheless there is a growing body of evidence suggesting that more fundamental forces might determine the observed pattern of differentials, irrespective of union organisation. Krueger and Summers (1988), and Dickens and Katz (1987a) report convincing evidence (for the US) showing that inter-industry wage dispersion is very similar for union and non-union workers, and that there is a high correlation between industry wages for union and non-union employees. Similar findings are reported, for the UK, in Nickell and Wadhwani (1989), and Blanchflower *et al.* (1989) where no substantial differences in industry effects appear to exist between the union and the non-union sector.

One potential explanation for these findings can be related to the threat of collective action. Dickens (1986), shows that non-union workers might benefit from the threat of collective action, as firms - which find costly to face union power - will offer higher wages to avoid unionisation. According to this hypothesis, wage premia are likely to be found in those industries where the costs of organising are low, where threat effects are stronger and where the firm has rents derived from market power[18]. In general, it may be argued that industry wage differentials do not appear to be a main union phenomenon. Conversely, the varying costs across industries of collective action avoidance might push some firms to pay higher wages.

4. Data Description

As already discussed in the introduction to this chapter, until very recently, little empirical work has been undertaken in Italy to investigate the characteristics of the wage structure. It was pointed out that data deficiencies represented the main reason for the lack of studies in the area. Indeed, data requirements to carry out

[18] The relationship between wage structure and product market power is analysed in some detail in the following chapter.

studies similar to the one proposed here, are quite demanding. Appropriate controls for personal characteristics of workers, together with job and industry attributes are the necessary information which such a data set should include. Although not optimal, the data set employed in this work contains most of the information needed to empirically evaluate competing explanations of wage determination. The survey carried out by ENI-IRI (Ente Nazionale Idrocarburi - Istituto per la Ricostruzione Industriale) contains information at the individual level on gross remuneration and employee characteristics, in Italian manufacturing industry. The sample was drawn from 100 representative firms distributed across the country, such that the data set can be considered close to a nationally representative statistical sample. The total number of workers sampled is 22,795 distributed into 7 industries and 89 different occupations (52 for white-collar and 37 for blue-collar workers). Gross actual remuneration includes all forms of compensation received by the individual in the year according to the normal working time (different for each sector), it also includes additional monthly payments and some kind of periodical compensation schemes. Conversely, it excludes family allowances and occasional payments. The survey refers to the occupational levels and the occupational structure of the firms sampled as of 31st October 1985. In addition to gross remuneration, the survey collects information on sex, age, tenure with the firm, occupation (with standard requirements necessary to accede to it -ie. education, previous experience in the job, etc.) and a full description of tasks and responsibilities. Finally, it includes the contractual occupational category as determined by the national union agreements, and a firm size variable (measured according to the number of employees). A detailed description of the variables used and their means can be found in the appendix.

Some general remarks concerning particular features of the survey are in order. Firstly, firms of medium/large size are over-represented in the sample; hence, as far as wage determination is concerned, the characteristics of small firms are likely to be under-estimated in the analysis. Secondly, the sample contains only firms covered by collective agreements; nonetheless, there is a substantial discrepancy

between actual gross earnings paid by firms and pay levels determined through collective bargaining. This indicates that a significant portion of the actual wage (10% on average for blue-collar workers; 20% and more for white-collars) is the result of individual bargaining and incentive schemes. Finally, the high labour experience (22 years on average) and length of job tenure (14 years on average) accumulated by individuals in the sample suggest that long-term employment, career ladders and internal (as opposed to external) mobility are likely to characterise the firms included. Therefore, in the terminology of segmentation theory, the present data set is better suited to analyse the features of the primary labour market.

Although some of the above features might be seen as limiting the explanatory power of our results, nevertheless there are clear advantages in working with a relatively homogeneous sample.

5. More Evidence on the Wage Structure

The basic methodology employed in this chapter is to estimate several standard cross-section earnings equations in order to evaluate the importance of industry and occupational affiliation on relative wages. Moreover, the main goal of the work is to assess the potential relevance of non-competitive explanations of wage determination as a vehicle to understand wage dispersion, rather than strictly discriminate among their different implications.

5.1 Inter-Industry Wage Differentials

According to the theoretical explanations reviewed in the previous sections,

we begin by specifying a standard earnings equation of the following form:

$$w_{ij} = \alpha + X'_{ij}\beta + Z'_j\delta + \varepsilon_{ij} \qquad [1]$$

where w_{ij} is the logarithm of gross actual yearly earnings for the i-th individual in the j-th industry; X_{ij} is a vector of human capital variables and occupational controls for the i-th individual in the j-th industry; Z_j is a vector of dummy variables for the j-th industry. Finally, α is the intercept term, ε_{ij} is the error term, and β and δ are the vectors of parameters to be estimated. Several specifications of [1] have been estimated to determine the importance of industry affiliation. The statistical adequacy of the estimated regressions has been checked by means of several diagnostic tests. In general coefficient estimates were statistically significant and in line with expected signs. Although the hypothesis of homoscedastic error terms was rejected at the conventional levels of significance, the OLS heteroscedastic consistent asymptotic standard errors did not differ substantially from the standard OLS ones (White, 1980). Finally, some general misspecification tests were implemented[19]. To allow for more flexible functional forms and test the robustness of the results obtained, more general earnings equations adding several interaction terms were also estimated . The results obtained proved to be very robust to the different specifications chosen. Detailed regression results and the relative diagnostic tests are reported in the appendix.

However, before turning to the estimates of the industry wage differentials, it might be interesting to discuss briefly the effects of human capital variables. In general, parameter estimates accord with findings of similar studies for different countries and on different data sets[20]. Returns from education suggest that an additional year of schooling is associated with an average increase of 5% in total

[19] These can also be interpreted as functional forms checks. In most of the cases, the linear (in parameters) specification employed in the estimation proved to be a satisfactory approximation.

[20] The stylised individual, chosen as a reference term, is a female worker with average education and average labour experience, working in the miscellanea industry with transport duties. As far as working conditions are concerned the reference categories include individuals not working with machines, not being strictly supervised and working in a small firm.

remuneration[21]. Each year of accumulated labour experience grants, on average, an earnings advantage of 1.5% with respect to first entrants. However, returns are marginally decreasing and they become negative after approximately 40 years of accumulated experience. The gender control dummy indicates that men of (observable) comparable skill have an average pecuniary advantage of 3% over females (see column 1 in table A1 of the appendix)[22]. Several interaction terms have also been included, though their statistical significance drops when further control dummies are added. The inclusion of industry controls hardly affects the pattern of estimates so far discussed; conversely, occupational controls reduce both returns from education and labour experience. This latter result might be explained considering that schooling and labour experience may constitute a pre-requisite for the admission into certain occupations. In one of the few comparable studies for Italy Cannari *et al.* (1989), using a different data set, report very similar results.

Table 1. presents estimated wage differentials for broadly defined industries. The differentials have been calculated as differences between the actual industry coefficients and the weighted average for total manufacturing (the weights are the number of workers in an industry in the sample)[23]. Standard errors have been calculated accordingly[24]. In this way, differentials can be interpreted as the proportional difference in wage between an employee in a given industry and the average employee in the manufacturing industry, after controlling for individual

[21] When 3 educational dummies (compulsory education, high school and degree levels) were introduced, the pattern of returns showed that individuals holding a degree earn, on average, 35% more than those with minimum education attainments (ie. reference category); while individuals with a high school diploma earn 15% more than those included in the reference category. No significant difference in earnings were detected between compulsory education and the reference category.

[22] The potential relevance of this result as an indication of gender discrimination is analysed in chapter 5.

[23] The weights used to calculate the differences are reported in the data appendix.

[24] The variance of the estimated differentials expressed as deviation from the weighted mean is as follows:

$$var(\gamma_i-\gamma^a)=var(\gamma_i)+var(\gamma^a)-2cov(\gamma_i,\gamma^a)$$

where $var(\gamma_i)$ refers to the variance of the estimated wage differential for the i-th industry, $var(\gamma^a)=W'VW$ is the variance of weighted average for the whole manufacturing industry (W are the weights, and V is the estimated variance-covariance matrix), and finally $cov(\gamma_i,\gamma^a)$ is the covariance term. In practice, standard errors reported do not adjust for covariance terms, and therefore the figures might slightly over-estimate (or under-estimate) their true values. However, on inspection the magnitude of covariances proved to be very small, hence the potenial bias should be negligible.

characteristics and occupational status. Industry dummies show a substantial impact on wages both jointly as well as individually[25]. The largest positive (with respect to the average) wage differential, for (almost) identical workers, is found in the petroleum industry (10%); conversely the textile industry exhibits the largest negative differential (-8%). Quite interestingly, after controlling for a wide range of characteristics, the ranking of "high" wage and "low" wage industries is very similar to the time series evidence previously presented. Focussing on the dispersion of wage differentials, we computed the standard deviation of the estimated coefficients both including and excluding quality control variables (see table 1). The addition of human capital controls - as previously described - does not affect either the size of the differentials, or their dispersion, suggesting that labour quality variables and industry affiliation controls might be orthogonal.

This is surprising, since one would expect that if observed and unobserved labour quality were to be the main determinants of industry wage dispersion, estimated differentials should be somehow affected. In particular, if it is reasonable to expect unobserved labour quality to be highly correlated with personal observed characteristics rather than with industry affiliation, then this evidence makes difficult to accept unmeasured ability as the main explanation of inter-industry wage differentials[26].

A further hypothesis, discussed in the previous section, concentrated on the existence of a compensating equilibrium for specific (non-pecuniary) job attributes which affect the utility of the individual. Although it will be particularly difficult to capture relevant non-pecuniary job attributes by simply adding control dummies for job related aspects, nevertheless if working conditions do play an important role in

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[25] The null hypothesis for all the coefficients being jointly zero was tested by means of an F-statistic, $F(6, 22760)=520.3$ and rejected. Although the presence of heteroscedasticity could introduce some bias in the calculation of the F-statistic, nevertheless the strong similarity observed between the standard OLS and the White's heteroscedastic-consistent variance-covariance matrices seem to indicate that the bias is very small.

[26] Ideally, one would like to have longitudinal data on industry switchers, as to control for time invariant characteristics as in Krueger and Summers (1988) and Gibbons and Katz (1989). Unfortunately, this kind of data is not available for Italy.

determining industry wage differentials, then their inclusion should alter in some way the estimated differentials.

Table 1. ***Estimated Inter-industry Wage Differentials***
(deviations from the weighted average)

Industries	***(1)***	***(2)***	***(3)***
Mechanical	-0.0294	-0.0278	-0.0290
	(0.0063)	*(0.0048)*	*(0.0044)*
Primary metals	-0.0443	-0.0427	-0.0417
	(0.0134)	*(0.0097)*	*(0.0095)*
Petroleum	0.0811	0.1012	0.1032
	(0.0076)	*(0.0062)*	*(0.0060)*
Chemical	0.0481	0.0251	0.0235
	(0.0058)	*(0.0055)*	*(0.0052)*
Textile	-0.1041	-0.0866	-0.0791
	(0.0096)	*(0.0073)*	*(0.0071)*
Food	0.0398	0.0623	0.0495
	(0.0141)	*(0.0122)*	*(0.0097)*
Miscellaneous	-0.0279	-0.0115	-0.0061
	(0.0051)	*(0.0135)*	*(0.0134)*
Standard Deviation[#]	0.064	0.061	0.061
Controls included[*]			
- *Human capital and occupations*	*no*	*yes*	*yes*
- *Working conditions*	*no*	*no*	*yes*

note: Wage differentials have been calculated from estimated earnings equations as reported in table A1. Standard errors in parentheses (see footnotes for calculation procedure)
A full description of variables and their meaning is contained in the appendix at the end of the chapter
[#] Standard deviations computed from reported coefficient estimates
[*] Control variables are: education, experience and its square, gender, 7 occupational dummies 2 working conditions dummies and 2 firm size dummies

The last column in table 1 reports the estimated wage differentials when working condition variables are added. These include : a variable indicating whether the individual works using machines or not (to control for the repetitiveness and the hazardness of the job), a variable indicating monitoring conditions (considering whether the individual is subject to strict supervision or not) and, finally, firm size

dummies (related to the disutility of working in large organisations characterised by a more impersonal job environment). By comparing columns (1), (2) and (3) of table 1, it is clear that the working condition variables included do not affect the pattern of differentials. Furthermore, according to the compensating differentials hypothesis, positive wage differentials should be associated with unpleasant working conditions; however, with the single exception of firm size, the negative signs detected seem to suggest exactly the opposite (see table A1)[27]. In other words, wage differentials appear to be "additive" rather than "compensative". These findings indicate that wage premia might represent rents for "good jobs" rather than being compensating differentials.

The evidence considered so far gives little support (if any) to the view that industry wage differentials are irrelevant, or that they can be explained by either unmeasured workers characteristics or compensating wage differentials. Conversely, most of the results obtained can be better rationalised in terms of some of the non-competitive explanations reviewed earlier on.

Efficiency wage theories predict a pattern of wage differentials of a similar type to the one found here. Differences in turnover costs, monitoring conditions or selection procedures can give rise to different optimal wage levels which firms would like to pay. In the terminology of Shapiro and Stiglitz (1984), the need to reduce shirking and malfeasance in the labour force pushes employers to either increase supervision or to pay wage premia to those workers endowed with self-controllable effort. In this way, the negative sign on the monitoring variable could also be interpreted as evidence for the existence of a trade-off between the extent of supervision and wage premia. Since monitoring conditions are likely to vary according to the organisation of labour and to production technologies, we expect supervision-premia to vary across industries (and firms)[28].

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[27] The positive impact, on wage levels, of firm size may be interpreted in different ways. It could represent a compensating premium, as previously discussed, or it may indicate a greater need of large organizations to elicit effort paying wage incentives.

[28] A more detailed analysis on the pattern of variation of supervision-premia by industry is considered in the following section.

Insider-outsider theories suggest that incumbent workers, who are protected by significant turnover costs, will be able to share rents with the firm. Since a lower turnover rate implies a longer job tenure, the positive relationship between wage levels and length of job tenure can be interpreted as tentative evidence that high-wage firms and industries experience less turnover[29]. The turnover version of efficiency wages is also consistent with this view. However, some caution is necessary in interpreting the estimated coefficient on job tenure as some endogeneity between wages and seniority might bias the result[30].

Finally, it is interesting to investigate how important are unions in shaping industry pay differentials. The lack of any detailed information on union status makes the present task particularly difficult[31]. However, with the obvious limits imposed by the available data, the following analysis attempts to provide some descriptive evidence on this issue. If the pattern of industry wage differentials were to be mainly explained by union behaviour, one would reasonably expect wage premia and union power to be positively and highly correlated across industries. Table 2 reports bivariate correlations between industry wage premia - after controlling for personal and occupational characteristics - and some indicators of union behaviour at the industry level. The variables considered are: union density[32], absenteeism and industrial disputes (index numbers calculated on averages for the period 1980-87). Industry wage premia are positively correlated (though weakly) with union density, giving some support to the hypothesis that union presence has some role in shaping wage levels[33]. Conversely, when we consider hours lost in industrial disputes as a proxy for union power, the correlation with industry wage premia becomes (weakly)

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29 The lack of data on quits limits significantly the analysis of the turnover implications for pay levels.

30 In chapter 7 we provide a more detailed analysis of the determinants of job tenure.

31 To our knowledge, due to the lack of data, no study has attempted to analyse in the context of the Italian economy the impact of unions on relative wages.

32 Since union confederations data generally include also union member who are retired, in order to attain a more reliable measure of effective union density (measured as percentage of unionised workers over total employment), retired members have been excluded from the figure considered.

33 However, this still leaves open the question of whether is the existence of economic rents to be shared, that makes workers more likely to be unionised in a given industry (ie. higher benefits from organisation and lower costs), or it is union activity that raises wages, in that industry, above those of less unionised industries.

negative. In other words, the payment of higher wages - as advanced by the union threat hypothesis - appears to be effective in maintaining industrial peace. Similarly, absenteeism is greatly reduced where wages are higher.

Table 2. ***Correlation Matrix between Industry Wage Premia and Union Behaviour***[1]

Variables	*Correlations*			
	Wage Premia	***Union Density***	***Absenteeism***	***Industrial Disputes***
Wage Premia	1.00			
Union Density	0.62	1.00		
Absenteeism	-0.81	-0.78	1.00	
Industrial Disputes	-0.41	-0.04	-0.08	1.00

note: [1] Union behaviour indicators refer to 1980-1987 averages (source: Asap, Confederazioni Sindacali).

This is consistent with efficiency wage explanations which stress the motivation and incentive role of pay levels.

In conclusion, the evidence considered in this section casts some doubts on the ability of standard competitive theories to explain the observed pattern of industry wage differentials. Conversely, non-competitive rent sharing explanations appear better suited to fit the observed facts.

5.2 The Occupational Structure of Industry Differentials

Whilst, until now, the emphasis has been placed only on industry wage differences, there are several other dimensions according to which wage dispersion can be analysed. In this section we shall focus our attention on occupational wage differentials. Table 3, reports the estimated occupational wage differentials (computed

as described in the previous section), both including and excluding human capital controls. In general, occupational dummy variables are statistically significant both as a group and (with few exceptions) individually[34].

Table 3. ***Estimated Occupational differentials***
(deviations from the weighted average)

Occupations	***(1)***	***(2)***
Man-Adm	0.1305	0.0595
	(0.0082)	*(0.0089)*
Techn	0.1277	0.0516
	(0.0069)	*(0.0087)*
Clerical	-0.0493	-0.0010
	(0.0071)	*(0.0087)*
Sales	0.2554	0.1659
	(0.0093)	*(0.0102)*
Transport	-0.1567	-0.0696
	(0.0070)	*(0.0182)*
Skilled	-0.1045	-0.0626
	(0.0078)	*(0.0072)*
Semi-skilled	-0.1346	-0.0770
	(0.0081)	*(0.0074)*
Unskilled	-0.2467	-0.1233
	(0.0098)	*(0.0091)*
Standard Deviation	0.173	0.095
Controls included*		
- Human capital	*no*	*yes*

note: see table 1.

When human capital variables are controlled for, the magnitude of the wage differences by occupation is reduced by almost a half. The overall variability (measured by the weighted standard deviation) also falls with the inclusion of labour quality controls. In contrast with the previous evidence on wage differences by industry, labour quality seems to account in this case for a significant portion of the estimated occupational wage differentials.

[34] The F-statistic for the joint significance of the occupational dummies is, $F(7;12,759)=248.2$. The same *caveats* discussed in the previous section apply.

If the occupational structure of wage differentials has a relevant role in explaining wage variation, than it might prove interesting to analyse the pattern of industry wage differentials across occupations. While in equation [1] the effects of human capital variables and industry affiliation were constrained to be the same for all occupations, in the methodology described below industry wage effects will be allowed to vary by occupation (human capital variables will still be the same for all occupations)[35].

One possible approach involves the estimation of an earnings equation (as in [1]) with industry dummies, occupational dummies and a full set of interaction terms between industries and occupations. This is also equivalent to a fixed-effects model, where the fixed effects are represented by the industry-occupation cells. Consider the following earnings equation,

$$w_{ij} = \mathbf{Y}'_{ij}\beta + \alpha_j + \varepsilon_{ij} \qquad [2]$$

where w_{ij} and ε_{ij} maintain their usual meaning, $\mathbf{Y}_{ij}$ includes human capital variables (but no occupational controls), β is a vector of parameters, and α_j is the fixed-effect for the industry-occupation cell j. Under the assumption that ε_{ij} is uncorrelated with the $\mathbf{Y}_{ij}$, and that the number of individuals in each cell is sufficiently large, then a consistent estimate of the industry-occupation fixed-effects (α_j) can be obtained[36].

Provided that we can interpret the estimated fixed-effects as industry-occupation wage differentials, it is then possible to examine the occupational structure of industry wage premia. The estimated fixed-effects were first grouped by occupations and then used to calculate the correlations of the industry wage differentials across occupations. The correlation matrix presented in table 4 indicates that, even after controlling for individual characteristics, large (bivariate) correlations

[35] The methodology employed follows closely the one outlined in Dickens and Katz (1987a).
[36] Consistency requires that n (the number of individuals in each cell) should tend to infinity (Hsiao, 1985).

exist between average wages in any two occupation within an industry. In other words, if one occupational group receives a high wage, all the remaining occupations in the same industry are also highly paid. This evidence strongly contrasts with the compensating differentials or the unobserved quality arguments, since it is unlikely that skill requirements and working conditions will systematically vary across industries.

Table 4. ***Correlation Matrix of Inter-industry Wage Differentials across Occupations***[1]
(fixed-effects)

	Occupations							
	Techn	*Man/Adm*	*Cleric*	*Sellers*	*Transp*	*Skill/W*	*Semi-sk/W*	*Unsk/W*
Techn	1.000							
Man/Adm	0.863	1.000						
Cleric	0.926	0.911	1.000					
Sellers	0.371	0.616	0.582	1.000				
Transp	0.978	0.878	0.936	0.508	1.000			
Skill/W	0.863	0.858	0.912	0.743	0.944	1.000		
Semi-sk/W	0.887	0.799	0.825	0.076	0.797	0.601	1.000	
Unsk/W	0.965	0.890	0.896	0.279	0.936	0.801	0.941	1.000

note: A full description of the variables and their meaning is contained in the appendix
[1] The regression from which fixed-effects were calculated contained: education, experience and its square, gender and exper*sex, exper*educ interaction terms.

If, for example, blue collar workers in an industry characterised by unfavourable working conditions (ie. hazardous job, close supervision, etc.) should receive a high wage to compensate them for the disutility associated with the job, this does not imply that secretaries or administrators, in the same industry, should also earn a pay premium.

Conversely, this pattern of differentials seems consistent with both the insider power and the union threat explanations. In both cases, the existence of economic rents to be shared with the firm is likely to increase the bargaining power of all incumbent workers, independently of whether they are organised or not (as in

Lindbeck and Snower, 1990). The standard insider-outsider theory, however, does not explain why some workers, whose turnover costs are very small, also share wage premia with other workers. Similarly, union threat explanations find it difficult to account for the fact that workers, who do not represent a collective threat for the firm, also benefit from the rent sharing process. Probably, the best explanation for this particular feature of the wage structure is provided by the sociological version of the efficiency wage hypothesis. Frank (1985) and Akerlof (1982, 1984), suggested that the existence of both horizontal equity constraints on pay and of wage norms, arising from fairness criteria, may act so as to extend to all occupations the pay premia earned by some groups of workers[37].

Although, none of the theories considered seem to be able, on its own, to explain satisfactorily the observed facts about the wage structure, nevertheless, as a whole, they provide an alternative general framework which quite successfully encompasses most of the observed facts considered here.

6. Robustness of the Results

The purpose of this section is to check the sensitivity of our main findings with respect to the specification chosen and to possible generalisations. The analysis presented in the previous sections has considered the pattern of wage differentials by mainly looking at the impact of industry and occupational affiliation on pay levels. Throughout the whole chapter, the maintained hypothesis has been to treat the effects of human capital variables, across industries, as the same. To check the validity of this assumption we run separate earnings equations for each industry. Results are reported in table 5. Most of the parameter estimates of the variables included appear

[37] Although not formalised in a model, these idea had been extensively discussed in the "old" literature of the 1960s. For example see: Reder (1962) and Phelps Brown (1962).

very similar for different industries. The overall variability of coefficients across industries - as measured by standard deviations and coefficient of variations - shows small values when human capital variables are considered, supporting the hypothesis that returns from education and labour experience do not differ significantly by industry. Conversely, the effects of working conditions, monitoring, and length of job tenure variables appear less homogeneous. This last result is worth further investigation.

Table 5. ***Estimated Coefficients of Earnings Equations by Industry***
(dependent variable is log wage)

Variables	*Industries*							
	Text	*Chem*	*Mech*	*Petrol*	*Food*	*Metal*	*S.D.°*	*C.V.°*
Educ	0.039	0.032	0.031	0.022	0.034	0.030	0.005	16.12
Exper	0.015	0.011	0.015	0.023	0.023	0.015	0.004	23.52
Exper^2	-0.0001	-0.0001	-0.0002	-0.0003	-0.0003	-0.0002	8E-3	40
Gender	0.073	0.099	0.057	0.078	0.113	0.075	0.020	24.24
Blue-Coll	-0.089	-0.058	-0.094	-0.086	-0.173	-0.096	0.039	39.77
Work-mach	-0.009#	-0.022	-0.017	-0.013	-0.002#	-0.012	0.008	68.64
Monitor	-0.074	-0.045	-0.137	-0.062	-0.029#	-0.102	0.045	66.96
Tenure	0.002	0.001	0.001	0.007	0.003	0.001	0.002	92.0
Constant	9.30	9.47	9.44	9.47	9.36	9.46	0.067	0.71
R^2	0.48	0.47	0.36	0.56	0.60	0.60	--	--
SE	0.024	0.045	0.030	0.020	0.019	0.018	--	--
N. obs	912	5,850	10,059	2,377	345	400	--	--

note: A full description of the variables and their meaning is contained in the appendix.
° (S.D.) - Standard Deviation (by industry) of estimated coefficients. (C.V.) - Coefficient of Variation (in percentage over the mean).
# Indicates a coefficient not statistically significant at the 5% level, all the other coefficients are statistically significant at the 1% level.

For this purpose, we interacted each of the variables which showed more volatility, with the industry dummies. Table 6, reports the results of the exercise. The relative instability (by sector) of some of the estimated parameters is confirmed by the joint significance of the included interaction terms. However, with the sole exception of the variable measuring working conditions (repetitiveness and hazardness of the

job), all the other variables maintain their signs and their significance. Whilst, no clear pattern across industries appears for the working conditions variable - ie. in all industries poor working conditions are also associated with pecuniary disadvantages - some interesting insights can be gained looking at the pattern of interactions for the remaining variables.

Table 6. ***Estimated Earnings Equations with Industry Interaction Terms***
(dependent variable is log wage)

Variables	*(1)*		*(2)*		*(3)*
Tenure	0.0021		0.0021		0.0026
	(0.0001)		*(0.0001)*		*(0.0003)*
Work.mach	0.0004		-0.0258		-0.0276
	(0.0069)		*(0.0026)*		*(0.0026)*
Monitoring	-0.1008		-0.0873		-0.1009
	(0.0027)		*(0.0073)*		*(0.0027)*
Interaction terms					
*Mech*Wmac*	-0.0329	*Mech*Monit*	-0.0510	*Mech*Tenure*	-0.0007
	(0.0075)		*(0.0078)*		*(0.0003)*
*Meta*Wmac*	-0.0509	*Meta*Monit*	-0.0172	*Meta*Tenure*	-0.0011
	(0.0168)		*(0.0171)*		*(0.0011)*
*Petr*Wmac*	-0.0359	*Petr*Monit*	0.0084	*Petr*Tenure*	0.0037
	(0.0100)		*(0.0100)*		*(0.0004)*
*Chem*Wmac*	-0.0299	*Chem*Monit*	0.0317	*Chem*Tenure*	-0.0013
	(0.0083)		*(0.0082)*		*(0.0004)*
*Text*Wmac*	-0.0229	*Text*Monit*	-0.0075	*Text*Tenure*	-0.0042
	(0.0131)		*(0.0159)*		*(0.0007)*
*Food*Wmac*	-0.0009	*Food*Monit*	0.0425	*Food*Tenure*	0.0002
	(0.0218)		*(0.0191)*		*(0.0010)*
Diagnostic tests					
- R^2	0.57		0.57		0.57
-SE of Reg.	0.0204		0.0202		0.0203
-F(6,227601)=2.8[†]	28.49		72.47		59.91
-N. observations	22,766		22,766		22,766

note: All regression contains human capital variables, industry and occupational control dummy. OLS heteroscedastic consistent asymptotic standard errors in parentheses. A full description of the variables and their meaning is contained in the appendix.

[*] The reference category (or base) is a stylised individual with the following characteristics: avg. education, avg. work experience, female, in transport occupation, in miscellanea industry, not working with machines, not being strictly supervised, in small firm and with avg. job tenure.

[†] F-statistic for the null hypothesis of the interaction terms being equal to zero.

As postulated by the monitoring-shirking version of efficiency wages, higher wages should be observed in those firms or industries where production technology makes the cost, of workers not performing up to a certain standard, particularly high. Casual observation suggests that this is likely to be the case for the chemical and petroleum industries, while it might not be as important in the mechanical engineering and/or textile industries. Bearing in mind the *caveats*, as previously discussed, concerned with the inclusion of the tenure variable in an earnings equation, it is interesting to notice that tenure is longer in those industries which were classified as high-wage. This, again, accords with the predictions of the turnover version of efficiency wages and with insider power theories.

A final check concerns the robustness of our results on the inter-industry wage structure, as we consider different stylised types of workers and firms. Table 7, compares the pattern of industry wage differentials according to: demographic characteristics (age, sex), worker-job attributes (skill, tenure), and firm size. Indeed, one may reasonably fear that different patterns of human capital accumulation or different characteristics of the labour force employed are responsible for much of the industry wage variation. For example, it might be argued that seniority rules push firms to share rents with older employees[38]. This, if the age composition of workers varies systematically across industries, can give rise to differences in pay. However, in this case, differentials exists only because of the inability to control for the expected lifetime income of new entrants in selected industries. A comparison of industry effects on the wages of young and old workers, suggests that this is not the case[39]. Also considering workers with long and short job-tenure similar results were reached. Evidence from gender (male/female) and occupational (blue/white collar) breakdown did not alter previous findings, and in both cases industry wage premia were highly correlated with their respective complement. The finding that the pattern

[38] This might be due either to accumulated specific human capital, or to last in first out criteria in employment (or deployment) decisions.

[39] The correlations of industry wage premia for each characteristic considered are reported in the last column of table 7.

of industry wage differentials is similar for blue-collar and white-collar workers, represents an interesting result. In fact, it provides some further (though indirect) evidence for the hypothesis that observed differentials are not a direct union phenomenon, as one would reasonably expect blue-collar workers to be more unionised than their white-collar counterparts.

Conversely, when the sample is divided according to firm size results are slightly altered. Small and large firms do not seem to share the same characteristics as far as industry wage differences are concerned.

Table 7. ***Wage Structure for Stylised Types of Individuals***

Group	*SD of differentials*[1]	*correlations*[2]
Age		
(1) less than 35 years	0.046 (7,046)	0.91
(2) more than 50 years	0.070 (3,457)	
Tenure		
(3) less than 5 years	0.024 (3,716)	0.70
(4) more than 15 years	0.071 (10,902)	
Firm size		
(5) less than 1,000	0.094 (3,229)	0.59
(6) more than 5,000	0.058 (8,799)	
Gender		
(7) male	0.061 (9,274)	0.94
(8) female	0.058 (4,223)	
Occupation		
(9) Blue-collar	0.077 (8,517)	0.89
(10) White-collar	0.054 (14,274)	

note: [1] Standard deviations of wage differentials calculated from a regression of log-wages, including the following control variables: education, experience and its square, sex (not included in (7) and (8)), 5 occupational dummies (not included in (9) and (10)), 2 working conditions dummies and 2 firm size dummies (not included in (5) and (6)).
[2] Bivariate correlations of the industry wage differentials between any two sub-samples.
[3] Sample sizes in parentheses

More than any other of the characteristics considered here, firm size seems to represent an important dimension of the wage structure[40]. This aspect of the wage structure will be analysed in the following chapter.

[40] However, as many studies have emphasized, firm size is likely to be even more important in explaining intra-industry, rather than inter-industry, wage differentials (Dickens and Katz, 1987b; Master, 1969; Mellow, 1982).

7. Concluding Remarks

The evidence presented in this chapter raises some doubts on the view that industry and occupational wage differentials can be explained by traditional competitive theories. The structure of relative industry wages appeared to be very stable in the long run. Moreover, when the pattern of inter-industry wage differentials is compared across different countries a remarkably similar structure emerges. This evidence calls for an explanation. Non-competitive theories of wage determination provide an alternative (to standard competitive theories) rationalisation to the observed facts.

After a short review of the existing literature, an empirical validation of the two different hypotheses has been proposed and a wide class of earnings equations have been estimated using micro-data for the Italian manufacturing industry. The results obtained provide little evidence in support of the view that wage dispersion can be explained by either unmeasured worker characteristics or compensating wage differentials. Conversely, the pattern of industry-occupation wage differentials seem to suggest that rent sharing mechanisms and fairness considerations are the main determinants of wage levels.

This is in no sense a rigourous test of the competitive paradigm *versus* a non-competitive explanation; rather, it is intended to provide some indication on the limits of competitive theory as a valid representation of the working of labour markets. Also, the purpose is to highlight some aspects of the wage determination mechanism which deserve further investigation.

The first point concerns the importance, even after controlling for a wide range of personal characteristics, of industry and occupational affiliation in explaining wage dispersion. It is noted that efficiency wage theories predict a pattern of wage differentials of a similar type to the one found in the empirical analysis. Also insider-

outsider and union threat theories can be consistent with some of the empirical findings. However, if the existence of "ability to pay", or more generally of economic rents, is of some relevance for wage determination, then it might be worth investigating further the role of both firms' product market power and its financial structure. This will be done in the following chapter.

A further point concerns differences in pay for (almost) identical individuals doing similar work. Empirical results suggest that men of comparable skill have an average pecuniary advantage over females. Is this evidence indicative of the existence of sex discrimination? This issue will be analysed in chapter 5.

Given that our data set is mainly composed of individuals covered by collective agreement, it seems important to investigate the relevance of wage bargaining in shaping wage levels. The impact of collectively negotiated wages on relative wages will be considered in chapter 6.

Finally, the positive relationship between wage levels and length of job tenure has been interpreted as tentative evidence that high wage industries experience less turnover. If this is the case, it might prove interesting to investigate which are the determinants of long term attachment of workers to firms. This will be done in chapter 7.

APPENDIX

Table A1. *Estimated Coefficients for the Earnings Equations*
(dependent variable is log wage)

Variables	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Personal characteristics						
Education	0.0524			0.0402	0.0345	0.0345
	(0.0169)			(0.0011)	(0.0010)	(0.0010)
Experience	0.0142			0.0191	0.0168	0.0155
	(0.0009)			(0.0009)	(0.0008)	(0.0008)
Experience^2	-0.0002			-0.0002	-0.0002	-0.0002
	(0.00001)			(0.00001)	(0.00001)	(0.00001)
Gender	0.0294			0.0427	0.0402	0.0467
	(0.0071)			(0.0070)	(0.0067)	(0.0066)
Exper*Gender	0.0016			0.0006	--	--
	(0.0003)			(0.0003)		
Exper*Educ	0.0001			-0.00009	--	--
	(0.00004)			(0.00004)		
Occupations						
Man-Adm			0.2872	0.1291	0.0988	0.0974
			(0.0065)	(0.0064)	(0.0062)	(0.0062)
Techn			0.2844	0.1212	0.0758	0.0756
			(0.0055)	(0.0059)	(0.0057)	(0.0057)
Clerical			0.1074	0.0686	0.0588	0.0581
			(0.0057)	(0.0059)	(0.0058)	(0.0058)
Sales			0.4121	0.2355	0.2417	0.2446
			(0.0073)	(0.0070)	(0.0068)	(0.0068)
Skilled			0.0522	0.0069	-0.0040	-0.0057
			(0.0058)	(0.0050)	(0.0048)	(0.0048)
Semi-skilled			0.0221	-0.0051	-0.0316	-0.0309
			(0.0061)	(0.0051)	(0.0049)	(0.0049)
Unskilled			-0.0901	-0.0537	-0.0635	-0.0635
			(0.0078)	(0.0066)	(0.0063)	(0.0063)
Industry						
Mechanical		-0.0015		-0.0163	-0.0233	-0.0230
		(0.0045)		(0.0031)	(0.0029)	(0.0029)
Primary metals		-0.0164		-0.0312	-0.0337	-0.0337
		(0.0114)		(0.0077)	(0.0075)	(0.0074)
Petroleum		0.1091		0.1128	0.1108	0.1092
		(0.0059)		(0.0040)	(0.0038)	(0.0038)
Chemical		0.0760		0.0366	0.0296	0.0295
		(0.0049)		(0.0033)	(0.0032)	(0.0032)
Textile		-0.0762		-0.0751	-0.0710	-0.0731
		(0.0081)		(0.0055)	(0.0052)	(0.0052)
Food		0.0678		0.0738	0.0593	0.0555
		(0.0121)		(0.0082)	(0.0079)	(0.0079)

cont.

Table A1.(cont.) ***Estimated Coefficients for the Earnings Equations***
(dependent variable is log wage)

Variables	*(1) OLS*	*(2) OLS*	*(3) OLS*	*(4) OLS*	*(5) OLS*	*(6) OLS*
Working conditions						
Working mach.					-0.0103	-0.0085
					(0.0035)	*(0.0026)*
Monitoring					-0.1220	-0.1194
					(0.0026)	*(0.0026)*
Firm size (m)					-0.0017	0.0040
					(0.0029)	*(0.0029)*
Firm size (l)					0.0138	0.0145
					(0.0020)	*(0.0020)*
Tenure						0.0025
						(0.0001)
Costant	9.0947	9.9705	9.8416	9.1398	9.3577	9.3558
	(0.0169)	*(0.0040)*	*(0.0051)*	*(0.0172)*	*(0.0172)*	*(0.0171)*
Diagnostic tests						
-R^2	0.48	0.47	0.36	0.56	0.60	0.60
-SE of Reg.	0.024	0.045	0.030	0.020	0.019	0.018
-Heteroscedasticity						
(i) χ^2(RHS)†	28.3(6)	35.1(6)	32.8(7)	48.6(19)	52.7(21)	53.2(22)
-Functional form						
(ii) $\chi^2(2)$=5.9	22.8	33.2	27.0	11.8	8.3	8.0
-RHS variables	6	6	7	19	21	22
N. observations	22,766	22,766	22,766	22,766	22,766	22,766

note: OLS heteroscedastic consistent asymptotic standard errors in parentheses. Reference category as in table 6.

† d.f. are reported in parentheses at the side of the tests

(i) The test for heteroscedasticity is Breush and Pagan's (1979) test, and it is distributed as $\chi^2(p-1)$ where p is the number of estimated parameters in the model.

(ii) The test for functional form is Ramsey's (1969) RESET test, it is a $\chi^2(2)$ test of the significance of the squared and cubes of the fitted values in each model.

Table A2 *Variables Definitions and their Means*

Variable	*description*	*mean*
Wage	logarithm of gross actual earnings	9.99
Personal characteristics		
Education	education (years) - compulsory school=8 - high school=13 - degree=17	11.96
Experience	potential experience defined as: (*age* - *education* - 6)	22.15
Gender	gender of individuals - males=1 - females=0	0.81
Tenure	tenure with current employer (years)	14.29
Working conditions		
# *Firm size*	firm size (measured as number employees): - *size (small)* 0<firm<999 - *size (medium)* 1000<firm<5000 - *size (large)* 5000 and over	 0.14 0.47 0.38
# *Monitoring*	conditions of supervision (if supervised on the job=1, otherwise=0)	0.72
# *Working mach*	working conditions (if working with machines=1, otherwise=0)	0.77
Occupations*		
# *Man_Adm*	managers and administrators	0.08
# *Techn*	technicians and related staff	0.29
# *Clerical*	clerical staff	0.20
# *Sales*	sellers	0.05
# *Transport*	transport workers (int. and ext.)	0.05
# *Skilled*	skilled workers	0.16
# *Semi-skilled*	semi-skilled workers	0.13
# *Unskilled*	unskilled workers	0.03
Industry		
# *Mechanical*	fabricated metal and machinery	0.44
# *Primary Metal*	primary metals	0.01
# *Petroleum*	petroleum	0.10
# *Chemical*	chemical	0.25
# *Textile*	textile	0.04
# *Food*	food	0.02
# *Miscellanea*	other manufacturing industries	0.13
number of observations		22,766

note: # Denotes a dummy variable. Dummy variable means can be interpreted as their relative proportion in the sample.

* The occupational categories employed follow, with some minor differences, the classification system developed by the European Community for the "Survey of the Structure of Earnings in Industry" (see, Eurostat, *SEI* 1972 Occupational Classification).

CHAPTER FOUR

Market Structure, Financial Performance and Wage Determination: An Empirical Analysis of Inter-firm Differentials

1. Introduction

The existence of large differences in wages for workers employed in different industries and occupations has long been recognized as an important "stylized fact" of the labour market. Moreover, it has been shown that the observed pattern of wage differentials is common to many different countries and is relatively stable over time[1].

Wage dispersion across industries and occupations may be indicative of differences in labour quality (education, labour experience, training and ability), or alternatively, it may result from different characteristics of the worker/job match which affect the utility of the individual. However, many studies have shown that large differences in wages are present even among workers with (almost) identical characteristics and doing apparently similar jobs. The observed differences, as shown in the previous chapter, appear to be correlated with industry and occupational affiliation, and quite independently from "unmeasured" characteristics or "compensating" considerations[2].

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[1] Krueger and Summers (1987) present a detailed analysis for different countries.

[2] Several studies present empirical evidence supporting this view: Commissione Carniti (1988), Cannari *et al.* (1989), Lucifora (1987) - for Italy; Dickens and Katz (1987a), Krueger and Summers (1987) and Katz (1987) - for the US; Hubler and Gerlach (1990) - for the FRG; and Blanchflower *et al.* (1988) - for the UK.

In the search for an explanation of these stylized facts, economic analysis has progressively abandoned models and interpretations in which the market mechanism always guarantees the achievement of both equilibrium and economic efficiency (as it does in the competitive paradigm). Conversely, both the importance of institutional and sociological factors have been introduced, alongside economic ones, as an alternative interpretation of the functioning of the labour market. The presence of unions, the impact of market power, the existence of internal labour markets, the influence of equity constraints in pay levels and norms of behaviour among individuals have proved to be important factors in the wage determination process[3]. According to this view, observed differences in pay levels across industries and occupations should be interpreted as the outcome of a complex mechanism which involves economic forces as well as socio-institutional factors[4].

In order to get a better understanding of the nature of these phenomena and of their role in shaping pay levels, an investigation of the distribution of wages is carried out. A closer look at the pattern of wage differentials reveals that large differences in pay (for workers with similar characteristics and doing similar jobs) exist even across firms within the same industry. That is, firm affiliation - within an industry which produces a relatively homogeneous product - appears to generate differences in pay for almost identical workers. If one might find it difficult to rationalise, in terms of a competitive explanation, the existence of large differences in pay among individuals due only to their industry or occupational affiliation, it becomes even more puzzling to explain why there should be differences across firms in the same industry.

The purpose of this chapter is to investigate the nature and the cause of these inter-firm wage differences within Italian manufacturing industry. Firms' behaviour in shaping pay levels will be analysed taking into account the characteristics of both the labour and the product market in which the firm operates, and also considering the role of its financial structure.

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[3] An excellent survey of alternative models of wage determination is contained in Katz (1987).

[4] A detailed analysis of the working of internal labour markets and of the role of socio-institutional factors in pay determination is developed in Doeringer and Piore (1971), and Marsden (1986).

Despite the long standing tradition of theoretical studies analysing the relationship between the functioning of the labour market and the product market, until very recently, little empirical work (particularly in Italy) has been done to assess the relative importance of these factors as determinants of pay levels. Whilst, in recent years, US and UK studies have provided considerable evidence on product market influences in wage determination, the lack of adequate data sets has prevented similar studies in Italy[5]. This chapter tries to fill this gap using micro-data drawn from two different surveys, which yield a considerable amount of information on both workers and firms characteristics.

The chapter is organised as follows. The next section presents some theoretical explanations for the existence of wage differentials among firms within the same industry. In particular, the role of product and financial markets on firms' pay policies will be considered. The third section specifies the empirical model employed and describes the methodology and the data set. Empirical results are presented and discussed in the fourth section. Some concluding remarks are contained in the final section.

2. Wage Differentials and Firm Characteristics: Some Theory

The textbook competitive labour market model offers several explanations for the existence of wage differentials across firms. As already discussed, these can arise from different human capital endowments of the employed workforce or from compensating differentials for non-pecuniary aspects of work which directly affect worker's utility. Alternatively, firm specific wage premia might reflect transitory differentials related to some form of technological advantage or higher returns on capital (supposing that technological shocks are not uniformly distributed or immediately available to all firms in the industry).

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[5] An extensive survey of the US literature on the relationship between market power and pay determination can be found in Dickens and Katz (1987b). For the UK evidence see, Stewart (1990).

However, available evidence does not accord with the implications of the competitive paradigm. Both, the observed persistence of wage differentials and the presence of large differences in pay even after controlling for a relevant set of personal characteristics and job attributes seem to rule out any explanations based on temporary disequilibrium factors and on pure competitive forces. In chapter 2, a number of alternative theories of wage determination have been proposed as possible explanations for the existence of wage dispersion. These alternative explanations focussed on the potential reasons which may push firms to pay above market clearing wages, and on the relevance of these factors across industries and occupations.

In what follows the main focus will, instead, be placed on those considerations which push firms to adopt pay policies which are substantially different from those of other firms operating in the same industry.

Traditionally two main arguments have been proposed in the literature to explain inter-firm wage dispersion: the first has drawn attention to the size and the organizational structure of the firm; the second, not completely independent from the first, has referred to firm's product market behaviour and, only quite recently, to its financial structure. We shall consider them in turn.

Firm size has important implications for the organization of work (Master, 1969; Mellow, 1982; Garen, 1985). A large firm - *ceteris paribus* - is more likely to be characterised by the following features: a greater rigidity in work norms, a stronger hierarchical structure, higher monitoring costs, larger investments in (specific) human capital due to higher specialization of tasks, and greater difficulties in disposing of a sufficient number of applicants to fill vacancies[6]. These considerations, related to firm size, may often require the payment of wage premia partly to compensate for the unfavourable working conditions (ie. strictly regulated work setting), partly to attract, remunerate and retain higher quality workers with specific human capital (Brown, 1985; Barron *et al.*, 1987).

In a similar way, firm's product market behaviour has important effects on the wage determination process (Weiss, 1966; Haworth and Reuther, 1979; Pugel, 1979). The

[6] This point is discussed in section 2.1.

existence of high profits in concentrated industries might increase the scope for workers (organised in a union or not) to capture some of the rents arising from market power. High level of product market concentration and firms collusion are more likely to guarantee higher than market clearing wages since it is easier for firms operating in these sectors to transfer higher costs onto prices. The extent of a firm's vertical integration is also likely to have the same effects.

Considering the lower costs (and the higher benefits) associated with worker organisation in concentrated industries, a higher union coverage and a stronger bargaining position will increase the possibility for rent sharing[7]. A final remark concerns the influence that the financial structure of the firm can have on its pay policy. Given the risks associated with entrepreneurial activity, each firm faces - in any period - some probability of going bankrupt. The higher this probability, the stronger will be the constraints on wage determination (Nickell and Wadhwani, 1987).

Several theoretical models have been proposed to explain the relationship between firms' characteristics and pay levels. For purely expositional convenience we shall group the studies into two broad categories. The first group gathers those explanations that, close in spirit to a competitive framework, have focussed on the structural characteristics of the firm trying to identify in some technical or organisational aspects the source of wage dispersion. The second group, while stressing the role of non-competitive forces in wage determination, has considered the inter-relationship between product market power, rent sharing mechanisms and financial performance. These are reviewed in turn.

2.1 Competitive Explanations

A traditional competitive explanation attributes to a supposed complementarity between capital intensity and labour quality requirements, the existence of different pay

[7] The early work of Dunlop (1944, 1957) still represent a benchmark in the literature on this topic. For more recent contribution see, Kwoka (1983); Gregg Lewis (1988) and Stewart (1990).

levels across firms. Firms with high capital-labour ratios employ better quality workers and therefore pay higher wages. An alternative hypothesis, advanced by Masters (1969), suggests that large firms have to pay wage premia to their workers to compensate them for the unfavourable working conditions which are likely to arise in big hierarchical organizations. Workers get a pecuniary compensation for doing repeated and more alienating tasks, which are rigidly regulated, and for working in a more impersonal job environment.

Oi (1983) showed that a perfectly competitive outcome is compatible with a non-homogeneous distribution of firms size, if entrepreneurial ability varies exogenously among individuals. As monitoring costs tend to increase with firm size (measured by the number of employees), the more able entrepreneurs - who are more likely to employ a larger number of workers - face proportionally higher costs as they employ more workers, than less able entrepreneurs who employ relatively fewer workers[8]. In equilibrium, small firms will find it profitable to expand output employing low quality workers even if this requires an increase in the monitoring activity. Conversely, large firms will find it more efficient to employ high quality workers who require less supervision. As long as worker quality (and productivity) is observable, larger firms will pay higher wages.

Weiss and Landau (1984), and Strand (1987) extend Oi's model to the case of imperfect observability (for the workers) of firms wage offers[9]. Since increasing firm size is likely to require a larger number of job applicants (so as to fill the vacancies), when labour supply falls short of the number of vacant jobs, large firms will be forced to offer higher wages and to lower hiring standards in order to satisfy their labour requirements. Therefore firm size and wages - *ceteris paribus* - will be positively correlated.

Finally, differences in the organisational structure of firms can give rise to differences in pay levels for workers of comparable quality. Large organisations have better career prospects for their workers and - *ceteris paribus* - might be able to offer steeper wage profiles to retain workers and reduce shirking (Lazear, 1981; Mincer, 1974). According to this

[8] In other words, according to this model, the marginal costs associated to the last worker employed is higher for the more able entrepreneur.

[9] The presence of informational imperfections might not be totally appropriate in a competitive setting. However, since it simply represents an extension of Oi's early model, it is convenient to include it here.

hypothesis large hierarchical organisations, relative to smaller ones, will pay on average higher wages and have lower turnover rates.

2.2 Non-competitive Explanations

In the type of models so far described the inter-firm wage dispersion arises from the different cost-minimising strategies concerning the capital-labour ratio or the labour-quality tradeoff adopted by firms. Perfect competition both in the product and in the labour market guarantees that any non-competitive wage premium will be traded away in the long run. However, alternative explanations investigate the possibility of departures from the competitive paradigm, and postulate the existence of a relationship between wage dispersion and firms' ability to produce rents. The existence of some market power or entry deterrence strategies, which characterise some of the incumbent firms, may represent a source of rents to be shared - quite independently from explicit collective bargaining - with workers. In other words, a firm's ability-to-pay may affect wage determination. This idea goes back to the early work of Slichter (1950), who suggested that managerial practices, in non-competitive markets, might account for the existence of different pay policies among firms. Managers can use their ability-to-pay to pursue different objectives, such as: lower turnover costs, higher effort and improved work norms[10]. A similar kind of relationship can be found in some versions of the efficiency wage hypothesis in which workers' perception of a fair wage is linked to the firm's ability-to-pay (Akerlof, 1984; Solow, 1979b). Inter-firm wage differentials might reflect differences in firms' monitoring conditions. Where individual effort is imperfectly observed and the cost of shirking are high, firms will be prepared to pay higher wages to induce workers to work hard (Shapiro and Stiglitz, 1984).

Bulow and Summers (1986) and Dickens and Lang (1987), identify the existence of a regime of imperfect competition - in the product market - and labour market segmentation as

[10] Ross and Wachter (1973), develop a model in which the payment of above market-clearing wages generate a pool of applicants who, if necessary, can be employed to meet an increase in the product demand without rising its price.

the major source of different pay polices adopted by firms[11]. In particular, firms operating in the primary sector of the economy can benefit from the payment of high wages, as this reduces shirking by employees and increases both productivity and profits. Conversely, firms in the secondary sector have no rents to share and no scope for paying higher than competitive wages, so no efficiency gain can be made.

The existence of the ability-to-pay is also a necessary condition for any organised group of workers, to establish a wage differential with respect to non-organised workers[12]. In fact, in a perfectly competitive market (in which firms employ the same technology, have identical effort functions and produce homogeneous products), any firm which following a bargaining process raises its wage above the general level, in the long run, will be driven out of the market by the increase in costs[13]. Hence, collective bargaining or the simple threat of collective action can have a stronger and lasting effect on wage determination when rents exists as a result of market power.

In those firms where unions are strong and the costs of collective action are particularly high, it may be profitable for the firm to share rents with workers paying a wage premium to prevent strikes and maintain industrial peace (Dickens, 1986)[14]. Union members' wages will be higher the more their firms stand to lose from a breakdown in wage negotiations.

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11 An excellent survey on labour market segmentation theories can be found in Cain (1986). For a definition and a detailed description of primary and secondary sectors, see: Doeringer and Piore (1971). Piore (1975), distinguishes three labour market segments: the "secondary" labour market, the "subordinate primary" labour market and the "independent primary" labour market.

12 For a survey of union effects on relative wages see, Gregg Lewis (1988).

13 Unless, workers are able to organise the entire market and guarantee full coverage of bargained premia to all employees, wage differentials among firms cannot be maintained.

14 It should be noted that the threat of collective action does not necessarily require the presence of an organised union. Lindbeck and Snower (1990), develop a model in which insiders (ie. incumbent employees whose positions are protected by substantial turnover costs) share economic rents with the firm.

2.2.1 *The Role of Financial Factors*

Whilst the models considered up to this point have a long standing tradition in the economic literature on wage determination, they fail to take into account an important potential factor which may influence firms' behaviour in setting pay levels, namely the financial structure of the firm (Ross, 1977).

The time lag which exists between production decisions and their monetary returns, introduces an element of risk which can be thought as if the firm, in any period, faces some probability of "bankruptcy". As long as managers take into account the possibility that the firm might not be solvent in the next period - that is might not be able to pay back its outstanding debt, interest charges, etc. -, then its financial structure is likely to influence firms behaviour in wage and employment decisions. In more practical terms, if, for example, the debt-equity ratio is high, managers will have less discretion in setting pay levels as they will be disciplined through the conditions set out by the lenders.

Only in recent years have a number of works considered the impact of financial factors on labour market decisions. Wadhwani (1986), Nickell and Wadhwani (1987, 1988) and Nickell, Wadhwani and Wall (1989) formulate models in which the financial structure of the firm and its probability of "bankruptcy" enter the production decisions affecting pay and employment levels. Malinvaud (1987) shows how, in the 80's in Europe, the widespread deterioration of firms' financial performance in terms of outstanding debt, cash flows and profitability, had a strong impact on the level of (un)employment. He also showed that the evolution of firms' average debt could be used to explain the pattern of the business cycle.

In a similar way, the existence of imperfect information and constraints in the capital market have been advanced to explain wage differentials and unemployment queues among firms (Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1987). In these terms, if either the fear of bankruptcy or the limited access to capital markets play a role in managerial decisions, then the financial structure of the firm should be considered as a further potential explanation of wage dispersion.

Finally, there is a large evidence from the industrial relations literature showing that the financial structure of the firm is a central feature in the wage bargaining process (MacKay *et al.*, 1971; Carruth and Oswald, 1987, 1989). In particular, if a firm is experiencing financial distress, the incidence of restrictive practices is likely to diminish. Moreover, in the extreme case of firms close to bankruptcy, wage-cuts can take place through the so called "reverse collective bargaining" (Henle, 1973; Mitchell, 1982; Nickell *et al.*, 1989)[15].

3. The Empirical Model and the Data

As the previous section has tried to describe, there are several competing explanations for the existence of inter-firm differentials. However, determining the empirical relevance of alternative hypotheses concerning the wage determination process can be interesting, as different implications emerge from different models. The theory surveyed provides some general indications as to which characteristics ought to be considered in the empirical analysis, and what their impact on wage determination is likely to be. In practice a test on the sign and the statistical significance of the variables included will be used to discriminate among different explanations.

In this section, we begin by specifying an earning function in which wages depend on personal and job characteristics, and firm specific fixed-effects[16]:

$$w_{ij} = X'_{ij}\beta + \alpha_j + \varepsilon_{ij} \qquad [1]$$

where w_{ij} is the logarithm of gross yearly wages for the i-th individual employed in the j-th firm, X_{ij} is a vector of personal and job characteristics relative to the i-th individual (employed in the j-th firm), α_j are firm characteristics, β is a vector of coefficients and ε_{ij} is the error term.

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[15] An overview of the evidence for the Italian economy can be found in, Carrieri and Perulli (1985).
[16] The methodology outlined in this section follows Dickens and Katz (1987a) closely.

As far as the simple competitive model is concerned, the wage equation should include only those variables that describe skill characteristics and working conditions (Becker, 1975; Brown, 1980; Rosen, 1986). Also firm size can act as a proxy for entrepreneurial ability or other characteristics related to the functioning of large organisations. Therefore, according to standard competitive explanations, firm specific characteristics should not have any effect on wages after controlling for the above listed variables[17]. The included firm fixed-effects, as in [1], can be interpreted as inter-firm wage differentials for similar types of individuals (ie. net of the influence of personal characteristics, occupational attributes and firm size).

A number of *caveats* are in order before we can proceed. First, if firm fixed-effects significantly contribute to the explanatory power of the regression, it may be interesting to pin down exactly their impact on wage levels. In other words, if fixed effects were to be perfectly orthogonal to the other set of variables included, then a unique variance decomposition could be obtained. However, if some correlation between the two sets of regressors is present, then no unique variance decomposition exists. The relevance of this problem is analysed, in the next section, by means of independent regression of log wage on each individual set of regressors. Second, if we are concerned about inter-firm wage dispersion, we would like to obtain consistent estimates of the α_j's. Given the specification adopted in [1], consistent estimates of the α_j's can be obtained assuming that for each j the number of individuals is sufficiently large (Hsiao, 1985, 1986)[18].

A further step concerns the nature of these firm specific dummies. In order to get an idea of the pattern of differentials, the estimated fixed-effects have been correlated with a wide range of firm characteristics.

In this way, if fixed-effects simply underline different pay policies of firms which are themselves the reflection of some specific firms attributes (for example, product market

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[17] One objection, to the above argument, could be that individuals unobserved ability is correlated with firm specific attributes and thus give rise to pay differentials across firms. However, it is not obvious why unobserved ability should vary systematically across firms which operate in the same industry, produce homogeneous goods, and have similar technology and skill requirements.

[18] This may not be such an unreasonable assumption, given that the data set contains mainly medium-large firms.

behaviour, or financial performance), then it appears reasonable to include the latter as explanatory variables. In other words, we can postulate a relationship between the α_j and firms attributes in the following terms:

$$\alpha_j = F(G_j, H_j) \qquad [2]$$

where G_j is a vector of product market characteristics and H_j is a vector of variables describing the financial structure, both referred to the j-th firm. Substituting for α_j from [2] into [1] and linearising, it is possible to specify a very general wage equation which can encompass different hypotheses,

$$w_{ij} = \alpha + X'_{ij}\beta + G'_j\gamma + H'_j\theta + \upsilon_{ij} \qquad [3]$$

where α, β, γ, and θ are the parameters to be estimated and υ_{ij} is the error term. In practice, in addition to the standard human capital variables, occupational and working conditions controls, several proxies for firm's product market behaviour and indicators of firm's financial performance will be considered.

As already discussed, it cannot be excluded that some multicollinearity is present among the regressors, suggesting some care is needed in interpreting the results. Nevertheless there is a trade-off between the misspecification arising from the omission of some relevant variables and the imprecision due to the presence of multicollinearity. The model selection strategy has been first to check the robustness of parameter estimates to the different specifications and secondly to include all the variables that significantly contributed to the explanatory power of the model. The actual variables employed and their theoretical implications will be briefly discussed in the following section.

3.1 Data and Variables Description

The data set employed in the present work is the result of a matching of two different data set: the ENI-IRI annual survey on earnings and the Mediobanca report on published company accounts. Both surveys cover medium-large firms of the Italian manufacturing industry[19]. The first survey contains information at the individual level on earnings, personal and job characteristic, and industry affiliation; while the second survey includes data at the company level collected from published balance sheets. The number of firms for which we had compete information is 75.

Personal characteristics are described by the following variables: gender, education, working experience and several interaction terms. Two job attributes control dummies (monitoring conditions and working with machines) and six occupational dummies have been included. Firm size, industry affiliation (9 control dummies) and several proxies for firm's product market behaviour have also been considered[20]. The idea is to include some variables which can influence the firms' ability-to-pay. In practice the following variables have been computed: capital-labour ratio, sales and profit per employee, an index of the degree of firm vertical integration, and a 5-firm market concentration index.

Finally, to assess firm's financial structure several financial indices have been tried. Again the idea is to capture some element that can influence the credit-worthiness of the firm. In the choice of the indexes, only the most commonly used by financial analysts have been selected, these include: debt-equity ratio, market capitalization of the firm and cash ratio[21].

The merging of data at different levels of aggregation also makes possible the consideration of the joint impact of micro and macro effects on pay levels. This feature of the data set employed is particularly attractive, for it is likely that individual's earnings depend on

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[19] The data sets considered refer to the 1985 surveys.

[20] Although it would be desirable to control for union effects, it should be noted that no information on union affiliation or union density are available, at any level of disaggregation, for the Italian economy. In this respect, we use particular care in interpreting the effect of firm size on pay (and of other variables correlated with union effects), as this might be capturing some union effect.

[21] Other financial indeces where tried but their explanatory power was very poor.

personal characteristics as well as firm and industry attributes. A detailed description of the variables and their means is contained in the appendix.

4. Empirical Results

In this section, the hypothesis that pay policies may differ across firms within the same industry is tested. As several previous works have suggested, there seems to be a relationship between the average wage paid by firms and certain of their characteristics. A recent study commissioned by the Italian Ministry of Labour to investigate the structure of wages, reported that firm size, capital intensity, and market power were crucial factors in shaping pay levels (Commissione Carniti, 1988). Similar conclusions can be found in other studies (ISRIL, 1986), and also for different countries (Nolan and Brown, 1983, Blanchflower *et al.*, 1988 - for the UK; Pugel, 1979, Podgursky, 1986 - for the US). However, in all these studies, the aggregate nature of the data (industry or firm level) makes it difficult to control for differences in labour quality. Moreover, if firm size and capital intensity are correlated with workers quality, then the impact of these firm characteristics on the level of pay is likely to be biased. From this point of view the employment of individual level data may prove useful, for it allows better identification of the role of firm characteristics on wage determination. More recent studies, for the US mainly, give support to this view (Dickens and Katz, 1987b, Krueger and Summers, 1987).

Analysis of Covariance

In order to assess the importance of firm attributes on pay levels and the pattern of wage dispersion across firms, we estimated equation [1] following the methodology outlined in the previous section. The basic decomposition of the sources of log-wage variation is

analysed simply by comparing the explanatory power of firms specific characteristics (fixed-effects), as opposed to individual and job attributes (covariates)[22]. In table 1, the proportion of the explained variation (R^2) is reported for each case considered. The increase in the explanatory power obtained after the inclusion of the fixed effects is equal to 13%. However, if any multicollinearity is present, between the two sets of regressors, the true impact of firm characteristics would be underestimated.

Table 1. Analysis of Covariance[1]

		Explained variation
Decomposition of variance		
(1)	*Covariates*	0.52
(2)	*Covariates and firm dummies*	0.65
(3)	*Firm dummies*	0.16
Marginal contribution to explained variance		
(4)	*Adding firm dummies* (ie. [(2)-(1)])	0.13
(5)	*Adding covariates* (ie. [(2)-(3)])	0.49
Total sum of squares		*932.2*
Standard deviation of log-wage		*0.234*
N. observations		*19,318*
N. covariates		*13*
N. firm dummies		*75*

note: [1] Dependent variable is log wages. Covariates include: education, experience and its square, sex, 5 occupational dummies, 2 working conditions dummies and 2 firm size dummies.

The inclusion of only firm fixed-effects provides an upper bound estimate of the impact of firm attributes (in our case 16%). Then, estimated fixed effects - after controlling for a wide range of personal and job characteristics - were grouped by industry and for each industry a measure of wage dispersion was calculated. To see whether personal and job characteristics have a role in explaining log-wage variation among firms we compare (in table 2), for each industry, the standard deviations of the mean wage differentials with the

[22] The fixed-effect terms resulted statistically significant as a group and individually. Their joint significance was tested by means of an F-test. The null hypothesis of H_0: $\alpha_j=0$, produced a statistic of $F(74,19317)=562$, and was rejected at all conventional significance levels.

estimated fixed effects[23]. Inter-firm wage dispersion, with the exception only of the mechanical engineering industry, is reduced by a half when individual characteristics are controlled for[24]. This result seems to provide some support to the hypothesis that firms paying high wages have, on average, a higher labour quality.

Table 2. Standard Deviations of Inter-firm Mean Wage Differentials by Industry

	Standard Deviations			*Correl-ations*[3]
	raw data[1]		*fixed*	
industry	*unweighted*	*weighted*	*effects*[2]	
Chemical	0.205	0.218	0.093	0.90
Mechanical	0.218	0.230	0.216	0.92
Primary metals	0.175	0.168	0.075	0.80
Telecommunication	0.170	0.175	0.053	0.58
Transport eq.	0.233	0.231	0.081	0.88
Pharmac. drugs	0.238	0.239	0.052	0.95
Electrical mach.	0.257	0.255	0.103	0.86
Petroleum	0.180	0.179	0.053	0.92
Other ind.	0.215	0.221	0.055	0.83
Manufacturing	0.221	0.228	0.125	0.88

note: A full description of the variables and their meaning is contained in the appendix.
1 The variable considered is log wages. Weights refer to firm size.
2 Fixed effects have been calculated from a wage equation.
Dependent variable is log wages. Control variables are: education, experience and its square, sex, 5 occupational dummies, 2 working conditions dummies and 2 firm size dummies.
3 Bivariate correlations between weighted average differentials and fixed effects.

However, it should not be interpreted as evidence supporting the traditional competitive explanation, as it is simply saying that the level and the structure of wages depend on the characteristics of the firm and of the employed workforce. Therefore, in addition to workers quality, it is important to consider firm characteristics like the technology employed, the degree of competition in the product market and other factors that are likely to influence firm's wage setting behaviour.

[23] The mean wage differentials refer to raw data, that is not controlling for personal and job characteristics.
[24] When compared with other industries, the behaviour of the mechanical engineering industry seems rather odd. A possible explanation takes into account the fact that unions' restrictive practices have traditionally been stronger in this industry as compared with others. In this case, the pursuit of a more egalitarian structure of pay levels may have altered firms hiring standards.

Correlation Analysis

To get a better understanding of the determinants of firms' wage policy, it is interesting to analyse which characteristics of the firm play an important role in shaping pay levels. To do this, the inter-firm wage differentials (fixed-effects) have been correlated with several firm characteristics. The correlation matrix reported in table 3 presents some evidence on the relationship between wage differentials and firm characteristics, after controlling for workers and job attributes. Average years of schooling and average working experience show a positive correlation with estimated differentials. The positive relationship is not confirmed for average tenure. As far as the wage/quality relationship is concerned these results seem to suggest that high-quality workers tend to be employed in high-wage firms even if wage premia are not mainly designed to remunerate specific personal characteristics. This evidence, might also be suggestive of the presence of principal-agent problems in labour relationships, as employers can only partially observe individual quality, and pay higher wages to attract (or select) high-quality workers (Weiss, 1980; Holzer, 1990)[25].

The finding that, even after controlling for individual and job characteristics, wage premia still exhibit a large negative correlation with the proportion of manual workers employed in each firm, can be explained with the presence of some type of horizontal equity constraints in the wage structure. In other words, fairness considerations may - *ceteris paribus* - restrict firms with a large share of manual workers from paying high wages (Akerlof, 1982; Akerlof and Yellen, 1988). Also, this is difficult to reconcile with the hypothesis that inter-firm wage differentials are the result of union power. In fact, one would expect manual workers to be more unionised than non-manual, such that a positive rather than a negative correlation should arise if unions bargain higher wages for their members. Alternatively, when in the occupational structure of the firm some groups of workers are

[25] It should be stressed that these pay strategies have a long standing tradition in the personnel and human resources literature. See for example, Heneman *et al.* (1986).

discriminated against and confined to certain occupations characterised by low pay levels and bad career prospects, then the level of pay of the remaining workers may be affected even without any direct discrimination towards them. The negative correlations between fixed-effect wage differentials and the proportion of women or the proportion of manual workers employed can also be rationalised in this way[26].

Table 3. Correlation matrix of inter-firm wage differentials and firm characteristics

	fixed effects	*over wage*	*educat*	*exper*	*tenure*	*women (%)*	*B-coll (%)*	*K/L ratio*	*Market value*	*Debt-Eq ratio*	*Cash ratio*	*Product*	*Sales p/h*	*Vert integr*
fixed effects	1.00													
over wage	0.89	1.00												
educat	0.22	0.57	1.00											
exper	0.28	0.23	0.46	1.00										
tenure	-0.15	-0.06	-0.08	0.65	1.00									
women(%)	-0.19	-0.12	-0.29	-0.35	-0.01	1.00								
Blue(%) collar	-0.25	-0.45	-0.81	-0.49	0.04	0.66	1.00							
K/L ratio	0.26	0.11	0.31	0.16	-0.00	0.20	-0.33	1.00						
Market value	-0.08	-0.02	-0.01	0.14	0.06	0.21	0.00	0.27	1.00					
Debt-Eq ratio	-0.11	-0.11	-0.03	0.02	0.03	-0.01	0.00	0.04	-0.01	1.00				
Cash ratio	0.14	0.04	-0.01	-0.33	-0.18	0.21	-0.21	-0.16	-0.08	-0.21	1.00			
Product	0.41	0.21	0.21	0.13	0.16	0.02	0.15	0.54	0.27	-0.02	0.17	1.00		
Sales p/h	0.46	0.34	-0.12	0.06	-0.02	0.01	0.05	0.47	0.23	0.59	-0.04	0.59	1.00	
Vert integr	0.25	0.24	0.04	0.02	-0.04	0.02	-0.02	-0.01	0.15	0.28	0.07	-0.12	-0.55	1.00
Profit p/h	0.17	0.03	-0.13	-0.23	-0.24	-0.02	0.09	0.11	0.04	-0.26	0.32	0.09	0.18	0.15

note: A full description of the variables and their meaning is contained in the Appendix.

26 The issue of wage discrimination by gender and the impact of occupational distribution on pay levels is analysed in chapter 5.

Firm's characteristics in terms of technology and product market behaviour also show large correlations with wage premia, stressing their importance in firms' wage determination strategies. Capital intensity, degree of vertical integration and profitability are positively correlated with firm ability-to-pay.

Finally, the relationship between firm's pay policy and its financial structure is partially confirmed by the results obtained. In particular, a high cash-ratio seem to increase firms ability-to-pay, while a high debt-equity ratio is likely to reduce it. The role played by the market capitalization of the firm appear to be less clear cut[27].

Regression Analysis

Since, it would be difficult to obtain more precise information from simple bivariate correlations, in the remainder of this section some attempts will be made to estimate a wage equation (as in [4]) trying to evaluate the relative effect and the statistical significance of the determinants of earnings.

Table 4 presents the results of our preferred equations. Parameter estimates generally bear the correct sign and are statistically significant at the conventional levels. Most of the included variables proved to be sufficiently robust to the different specifications tried, suggesting that multicollinearity might not be a problem severely affecting the results. Several diagnostic tests have been performed and no serious misspecification problems were detected. Since some specifications seem to suffer from heteroscedasticity in the residuals, White standard errors have been computed[28]. The functional form adopted was also accepted in most of the cases suggesting that no particular restriction has been imposed on the data by choosing a linear (semi-logarithmic) approximation.

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[27] The poor performance of this variable may also depend on its measurement. See the appendix for variable definitions.

[28] White correction is reported only in OLS estimations. However, a direct comparison of OLS and White standard errors did not show large differences.

Table 4. ***Estimated Coefficients of Earnings Equations***
(controlling for individual and job characteristics)

	(dependent variable - log of gross wages)					
Variables	*(1) OLS*	*(2) OLS*	*(3) OLS*	*(4) OLS*	*(5) IV*	*(6) IV*
Job attributes						
Work.mach.	-0.0241	-0.0218	-0.0240	-0.0233	-0.0339	-0.0366
	(0.0029)	*(0.0026)*	*(0.0028)*	*(0.0028)*	*(0.0031)*	*(0.0036)*
Monitoring	-0.1069	-0.1087	-0.1099	-0.0321	-0.1065	-0.1012
	(0.0029)	*(0.0026)*	*(0.0028)*	*(0.0071)*	*(0.0033)*	*(0.0036)*
Product market						
Firm size (med)	0.0278	0.0409	0.0275	0.0854		
	(0.0037)	*(0.0267)*	*(0.0036)*	*(0.0065)*		
Firm size (lar)	0.0069	0.0083	0.0095	0.0075		
	(0.0039)	*(0.0417)*	*(0.0038)*	*(0.0066)*		
*Monit*size(med)*				-0.0823		
				(0.0076)		
*Monit*size(lar)*				-0.0919		
				(0.0077)		
K/L ratio			0.0072	0.0081		
			(0.0055)	*(0.0055)*		
Vert.int.			0.0025	0.0025		
			(0.0002)	*(0.0002)*		
Lab. product.			0.0005	0.0005		
			(0.00002)	*(0.00002)*		
Profit (p/h)#						0.0058
						(0.0002)
Concentration (5-firm)#					0.0022	
					(0.0002)	
Financial structure						
Debt-eq ratio			-0.0034	-0.0034		
			(0.0008)	*(0.0008)*		
Cash-ratio			0.0016	0.0016		
			(0.00009)	*(0.00009)*		
constant	9.2277	9.1250	9.1412	9.0890		
	(0.0117)	*(0.0286)*	*(0.0116)*	*(0.0115)*		
Control variables included[1]						
Labour qual.(9)	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Industry (8)	*yes*	*no*	*yes*	*yes*	*no*	*no*
Fixed eff. (75)	*no*	*yes*	*no*	*no*	*no*	*no*

continued

Table 4. (cont.) *Estimated Coefficients of Earnings Equations*

Variables	*(1) OLS*	*(2) OLS*	*(3) OLS*	*(4) OLS*	*(5) IV*	*(6) IV*
Diagnostic tests						
-R^2	0.57	0.65	0.60	0.60	0.50	0.45
-MSE	0.020	0.016	0.019	0.019	0.024	0.031
-Heteroscedasticity						
(i) $\chi^2(75)$=90.5	120.1	85.1	99.8	99.3	101.0	91.8
(ii) χ^2(RHS)[†]	56.1(21)	93.3(87)	58.2(26)	58.4(28)	36.7(12)	34.2(12)
-Overid.Restrictions						
(iii) $\chi^2(1)$=3.8	n.a.	n.a.	n.a.	n.a.	5.0	2.8
-Functional form						
(iv) $\chi^2(2)$=5.9	5.1	3.8	4.6	4.6	n.a	n.a.
-RHS variables	21	87	26	28	12	12
-N. observations	19,318	19,318	19,318	19,318	19,318	19,318

note: OLS heteroscedastic consistent asymptotic standard errors in parentheses (only for OLS estimators)
A full description of the variables and their meaning is contained in the appendix.
[@] denotes variables instrumented: profitability per-empl. and 4-firms concentration ratio.
[†] when d.f. differ, they have been reported in parentheses at the side of the tests.
[1] labour quality controls are: education, experience and its square, sex and 5 occupational dummy variables. The number of industry and firm controls included is reported in parentheses.
(i) The test for heteroscedasticity is a $\chi^2(75)$ test of the significance of the dummy variables in a regression with the squared residuals as dependent variable.
(ii) The test for heteroscedasticity is Breush and Pagan's (1979) test, and it is distributed as $\chi^2(p-1)$ where p is the number of estimated parameters in the model.
(iii) Test of the overidentifying restrictions, it is asymptotically distributed as a $\chi^2(g)$, where g are the overidentifying restrictions (Hausman, 1983).
(iv) The test for functional form is Ramsey's (1969) RESET test, it is a $\chi^2(2)$ test of the significance of the squared and cubes of the fitted values in each model.
Instruments included sales per employee and capital-labour ratio.

As to deal with the potential endogeneity of a particular set of variables, in some specifications an Instrumental Variable (IV) estimator was used to obtain consistent estimates. Human capital variables, industry and occupational controls confirm their importance in explaining log-wage variation, and estimated parameters accord with previous findings (see chapter 2)[29]. No evidence for compensating wage differentials is found, while a

[29] The more detailed industry breakdown available in the present data set, as compared with the one employed in chapter 3, suggests that for a representative worker affiliation to pharmaceutical, chemical, motor vehicles, petroleum and telecommunication industries guarantees a positive wage premium as opposed to affiliation to mechanical engineering (excluding vehicles) and metal industries. Quite interestingly the former industries, in Italy, have been traditionally characterised by a high concentration (pharmaceutical, chemical and motor vehicles) or low international competition (petroleum, telecommunication); conversely, the latter face a higher competition in the product market and are exposed to international competition (metal engineering, mechanical). Casual observation also suggests that industry wage premia do not necessarily reflect higher union pressure. For example, metal and mechanical industries have a reputation for being highly unionised as well as having a leading role in industrial relation practices.

trade-off between extent of supervision and wage premia is detected instead. Firm size is positively related to wage levels, also when the latter is interacted with the extent of monitoring there is evidence that the scope for paying wage premia as opposed to strict monitoring (ie. to avoid shirking) increases with firm size. This result could be consistent with the hypothesis advanced by shirking models. All specifications contain the variables so far described.

The addition of product market and financial variables improves the explanatory power of the earnings function, without affecting the estimates of the variables already included[30]. Capital intensity, average productivity and a vertical integration index show a positive (though small) impact on wage levels, providing some support to our early hypothesis that product market conditions matters.

A further issue we wish to consider is the influence on pay of product market concentration. Several studies have shown that concentrated industries pay higher wages, as monopoly rents are generated for incumbent firms (Geroski *et al.*, 1982; Kwoka, 1983). However, the validity of concentration ratios as proxy for product market power and the existence of monopoly rents has been questioned on the grounds that it represents the structure of the industry rather than the performance of the firm. Conversely, it has been argued, economic profitability should be used. Since it is unlikely that profitability (ability-to-pay) is independent of wage setting procedures, OLS estimates might be biased as a result of the implied endogeneity[31]. Therefore, after testing for the endogeneity of these variables in the wage equation[32], we used an IV estimator to obtain consistent estimates. Although both variables show a positive relationship with wages, the impact of profitability is more pronounced. This result is particularly interesting since according to the standard competitive view profits and wages should be negatively related.

One point worth discussing is how collective bargaining could be related to these findings. A lot of emphasis has been placed in the above discussion on product market power

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30 Product market and financial variables resulted statistically significant both jointly and individually.

31 Intuitively, profitability affects wages and wages, in turn, can influence profitability.

32 The result of the Hausman (1978) tests were the following, H_C: F(1,19317)=4.7, and H_P: F(1,19317)=13.4; where the subscript $_C$ and $_P$ denote concentration and profitability respectively.

aspects and on entry deterrence strategies pursued by incumbent firms. In this respect, the presence of unions could reinforce the relevance of these issues, as union behaviour might well favour firms' ability to produce rents. Conversely, if, as suggested in several recent studies (Hirsch and Addison, 1987 - for the US; Metcalf, 1989; Machin, 1989 - for the UK), unionisation and union practices have a negative impact on firm's economic performance and on profitability, then a weak (if not negative) impact of profit on wages should be expected. Moreover, since profitability is also dependent - *ceteris paribus* - on union strength in extracting rents, then the total effect is *a priori* ambiguous[33].

The positive and significant impact of profitability on wages, as it emerged from the empirical analysis, can therefore be explained in different, though not inconsistent, ways. One interpretation would reduce the importance of collective bargaining in shaping actual pay levels, arguing that unions bargain over a minimum wage - relevant only for the less skilled workers -, while sufficient freedom is left to the employer to alter the pattern of wage levels through merit-pay schemes or performance-related payments[34]. A second interpretation would suggest that the alleged disruptive influence of unions on economic performance is over-emphasized and unions do not necessarily undermine firm profitability. On the contrary, according to this view, unions care about firms good performance as it guarantees higher wages[35]. In both cases sufficient discretion is left to the firm to set wage (and employment) levels as to maintain a good economic performance.

Finally if it is true that firms rely on the financial system for investment and production decisions, it seems reasonable to expect that their financial structure will also influence pay determination policies. In this respect, a high debt-equity ratio showed a negative effect on pay levels, as to indicate that generally financial distress reduces firms ability-to-pay. Conversely a high cash-ratio, included as to represent firm credit-worthiness,

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[33] Note that the present discussion concerns only the effects of unions on wages in the unionised sector. Therefore the interpretation considers different union densities, across firms or industries, rather then a union versus non-union affiliation.

[34] The relationship between bargained outcomes and actual wage levels is analysed in some depth in chapter 6.

[35] Carruth and Oswald (1989), provide extensive empirical evidence showing that collective bargaining explicitly takes into account firm economic (and financial) performance in setting wage requests.

influences positively the level of pay. Other financial indicators were tried but did not seem to play any role on pay level and so they were not included.

5. Concluding Remarks

This chapter has examined the pattern of inter-firm wage differentials in the context of the Italian manufacturing industry. The importance of firm characteristics on wage determination has been analysed using a data set which combines information at the individual level for the workers, with information at the company level for the firms in which individuals are employed. Several theories advanced in the literature to explain the existence of differences in pay levels, for (almost) identical workers, across firms have been reviewed and their implications have been compared with the empirical results obtained. The importance of firm characteristics in explaining wage dispersion is confirmed in the present study.

Labour quality, employment composition (by gender and skill), degree of competition in product markets, and financial performance proved to be the factors which mostly contributed to the explanation of the observed differences in pay levels. The lack of information concerning union presence and behaviour prevents any definite conclusion about the impact of collective bargaining on the pattern of differentials. However, indirect evidence suggests that collective bargaining influences only partially the actual wage structure. Firm profitability, in contrast with the view commonly held, is positively correlated to wage levels. In general, the evidence obtained suggests that quite independently from collective bargaining, wages seem to be influenced by product market conditions and by the firm's economic performance. No evidence was found in support to the hypothesis that wage dispersion is the result of a compensating wage differential equilibrium, or that purely technological factors are responsible for the observed differences in pay.

The purpose of the present chapter has been to provide extensive descriptive evidence on the pattern of inter-firm wage differentials and on the relationship between pay levels and firm characteristics, rather than directly discriminate among competing theories of wage determination. Nevertheless, it has been shown that most of the results are inconsistent with a perfect competitive view of the functioning of the labour market. The existence of both ability-to-pay and of different forms of insider power, quite independently from collective bargaining, appear to give rise to a rent sharing process in which some firms - within a given industry - pay a high wage while others do not.

This evidence is consistent with a wide class of non-standard theories of wage determination, such as: insiders-outsiders, efficiency wages, labour market segmentation and wage bargaining.

ANNEX

One of the hypotheses often advanced to explain the observed pattern of wage differentials and their relationship with firm and market characteristics - as shown in the previous analysis - has been to postulate the existence of a segmented labour market. According to this view, the labour market is composed of different segments hardly communicating and characterised by different attributes. However, other theories stress the importance of firm and industry attributes as main determinants of wages, without relying on the hypothesis of independent segments (for example efficiency wage theories). In our case, since most of the firms included in the data set are likely to be in the so called "primary" sector, the existence of a pattern of common factors which determine differences in pay policies should be interpreted as evidence of a dual, "subordinate" and "independent" respectively, primary labour market, as defined in Piore (1975).

In the light of the results previously obtained and according to the dual labour market characterisation described above: labour quality, occupational structure, firm size, capital intensity, profitability and financial performance should be the main determinants of wage levels. In other words, large firms with a high capital-labour ratio, employing a small percentage of women and manual workers, making high profits and showing a solid financial structure will tend to pay high wages. Firms characterised by opposite features will generally pay low wages.

Principal Component Analysis

One way to check the significance of this hypothesis is to use a principal component analysis. This methodology consists of a technique for examining the relationships among different variables, and identifying the nature of their common characteristics (ie.

components)[36]. The coefficients of each principal component can be interpreted as the correlation between each of the variables and the respective component. Results are reported in table 5.

Table 5. ***Principal Component Analysis***
(average firm characteristics)

Variables	***Principal components***			
	(1)	*(2)*	*(3)*	*(4)*
Wage	0.18876	-0.09679	-0.37875	0.49156
Education	0.53824	-0.07181	0.15083	0.03275
Lab. exper	0.51941	-0.02911	0.22909	-0.00066
(%) female	-0.01283	0.35114	0.41103	0.07057
(%) blue-coll	-0.11963	0.47705	0.43438	-0.16931
Tenure	-0.27831	-0.04636	0.08740	0.23455
Firm size	0.48920	0.05146	0.27975	0.08364
Productivity	0.16086	0.51533	-0.37751	0.07811
Profitability	0.15780	0.36338	-0.39512	-0.38550
Cap-Lab ratio	-0.00416	0.48023	-0.09879	0.41022
Debt-Eq ratio	-0.08064	0.02630	0.17137	0.58191
Eigenvalue	3.804	2.111	1.740	1.097
(%) Explained	28	19	15	9
Cumulative explain.	28	47	63	73

note: see Appendix for variable definitions

The first component extracted accounts for 28% of the total variation, and it is positively correlated with: average wage level, education attainment, labour experience, firm size, productivity and profitability. Conversely, it is negatively related to the proportion of women and manual workers employed, and to the credit-worthiness of the firm. Although one might expect capital intensity and job tenure to be positively correlated to the first principal component, the estimated coefficients show, in both cases, a negative sign. The second component exhibits a different pattern of correlations, however its interpretation does not appear straightforward.

36 Each component is a linear combination of the original variables considered, with coefficients equal to the eigenvectors of the covariance matrix. The principal components are then sorted by descending order of the respective eigenvalues, which are equal to the variances of each component.

In conclusion, this evidence seems to be in line with most of the results previously obtained, and also consistent with the view that the labour market can be described in terms of different segments characterised by different attributes. In particular, labour quality, firm size and profitability stand as main features which distinguish high-wage from low-wage firms.

APPENDIX

Table A1. ***Description of Variables***

variable	*description*
Wage	- logarithm of gross annual remunerations: it includes all form of compensation according to the normal working time, it excludes family allowances and occasional payments.
Educ	- educational attainment (in years)
Exper	- potential labour experience: (age-educ-6)
Sex	- gender dummy: (male=1; female=0)
Tenure	- tenure with current employer (in years)
Occupations	(Pro-Tec) Professionals and Technicians (Man-Adm) Managers and Administrators (Cleric) Clerical (Skilled) Craft workers (Semi-skill) Semi-skilled workers (Unskilled) Unskilled workers
Monitor	- monitoring conditions (strictly monitored=1; 0 otherwise)
Work-mach	- working conditions (working with machine=1; 0 otherwise)
Size	- Number of employees (small) 0-999 (medium) 1,000-5,000 (large) over 5,000
Industries	(Chemical, Mechanical, Primary metal, Telecommunication, Transport equipments, Pharmaceutical, Electrical machinery, Petroleum, Other industries) - Mediobanca industry classification
K/L ratio	- Capital to labour ratio: K - fixed assets as reported in the company accounts. L - total number of employees in the firm. *Computed as (K/L)*
Sales p/h	- Sales per employees in employment
Produc	- Productivity - Value added per employees in employment
Vert-int	- Index of firm degree of vertical integration - *Sales divided by value added*
Profit	- Profitability - *Trading profits per employee in employment*
Concentration	- 5-firms sales concentration ratio (in percentage) - source: G. Martini (1989).
Mark-value	- Market capitalisation of equities - *Share capital at market prices*
Debt-eq ratio	- Debt-equity ratio - *(Medium and long-term debt + short-term debt) divided by (Total equity capital + Reserves)*
Cash-ratio	- Cash ratio - *(Working capital) divided by (total current liabilities)*

source: ENI-IRI and Mediobanca.

Table A2. ***Means of Variables*** *(aggregation by industry)*

Variables	***Industries***				
	Chem	*Mech*	*Metal*	*Telecom*	*Transp*
log(wage)	10.04	9.98	9.95	10.26	9.94
Labour quality					
education	12.19	11.85	11.72	11.53	12.12
lab-exper	22.97	22.43	23.35	23.69	22.41
(%) male	0.86	0.83	0.85	0.77	0.82
(%) blue coll	0.43	0.36	0.44	0.39	0.32
tenure	14.67	14.79	14.88	14.18	14.92
Occupation					
(%) Pro-Tec	0.34	0.34	0.22	0.21	0.36
(%) Man-Adm	0.06	0.08	0.08	0.11	0.10
(%) Clerical	0.12	0.18	0.19	0.28	0.20
(%) Skilled	0.30	0.23	0.30	0.21	0.18
(%) Semi-skill	0.16	0.08	0.16	0.13	0.08
(%) Unskilled	0.01	0.05	0.03	0.05	0.05
Job attributes					
(%) Work-mach	0.19	0.28	0.22	0.22	0.27
(%) Monitoring	0.30	0.29	0.25	0.16	0.29
Product market					
K/L ratio	106.01	60.81	256.62	367.53	56.81
Sales (p/h)	249.97	129.20	767.70	411.93	101.04
Vert-int	0.28	0.41	0.23	0.49	0.34
Product	56.3	47.6	102.6	101.7	38.4
Profit (p/h)	1.38	3.42	19.50	8.21	1.42
Concentration	35.8	24.2	35.0	88.4	80.9
Financial structure					
Mark value	320.27	108.90	1341.86	361.36	659.46
Debt-eq ratio	1.56	1.37	1.51	0.82	1.48
Cash-ratio	2.56	7.27	1.00	3.77	2.60
Num. obs.	4815	2956	1702	1517	2409

continued

Table A2.(cont.) ***Means of variables employed*** *(aggregation by industry)*

Variables	***Industries***				
	Pharmac	*Electr*	*Petrol*	*Others*	*Tot-Manuf*
log(wage)	10.09	9.98	10.11	9.97	10.09
Labour quality					
education	12.40	12.18	11.81	11.94	12.01
lab-exper	21.26	19.21	23.38	20.96	22.26
(%) male	0.75	0.78	0.84	0.66	0.81
(%) blue coll	0.34	0.31	0.42	0.29	0.36
tenure	13.27	12.24	15.51	14.48	14.62
Occupation					
(%) Pro-Tec	0.33	0.36	0.22	0.27	0.30
(%) Man-Adm	0.07	0.09	0.08	0.09	0.08
(%) Clerical	0.19	0.18	0.22	0.30	0.20
(%) Skilled	0.21	0.19	0.30	0.20	0.24
(%) Semi-skill	0.17	0.08	0.17	0.09	0.12
(%) Unskilled	0.01	0.06	0.001	0.03	0.03
Job attributes					
(%) Work-mach	0.15	0.24	0.18	0.18	0.22
(%) Monitoring	0.28	0.27	0.24	0.18	0.26
Product market					
K/L ratio	88.64	61.21	382.51	48.01	133.57
Sales (p/h)	49.55	224.94	266.60	42.60	346.90
Vert-int	0.34	0.44	0.13	0.32	0.33
Product	68.7	58.8	92.2	52.8	64.8
Profit (p/h)	6.52	7.99	8.50	4.23	4.11
Concentration	45.7	61.9	56.8	46.6	50.8
Financial structure					
Mark-value	49.55	224.94	266.60	42.60	520.49
Debt-eq ratio	0.68	1.15	2.77	0.49	1.36
Cash-ratio	3.93	15.95	1.69	12.51	5.56
Num. obs.	1029	2240	1206	1444	19318

CHAPTER FIVE

Wage Discrimination and Female Occupational Intensity[1]

1. Introduction

In most countries over the last 15 years there has been a considerable increase in the earnings of women relative to men. The European Economic Community (EEC) as a whole experienced, over this period, an average increase in the female to male earnings ratio of approximately 10 per cent. Focusing on the Italian experience, as shown in figure 1, average hourly earnings for women in 1971 were about 77 per cent that of men. In the last decade the ratio has been increasing further closing the gap in pay between the sexes. This mirrors closely the trend in the rest of the EEC[2]. This finding is partly the result of the increasing concern both in the field of legislation and in judicial decisions relating to the equality of men and women over pay issues. Although much of the discussion in this area has concentrated on the issue of *unequal pay for equal work*, there is a growing body of evidence showing that differences arise from the differential occupational distribution of men and women in the labour market.

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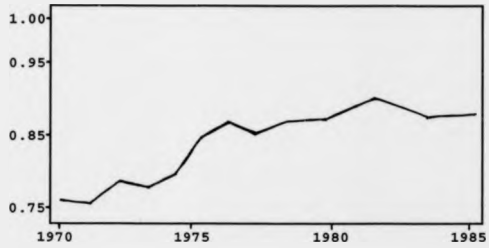
[1] This chapter is based upon joint work with B. Reilly, published in *Labour*, Vol.5, 1990.

[2] For a detailed analysis of the secular decrease in the gender-related wage differential, see Bettio (1985). Additional evidence relative to the Italian experience can be found in Del Boca (1987) and Martinelli (1988).

Figure 1 - Female-Male Earning Ratios in Italy (1971-1985)

(average gross hourly earnings)



Source: Yearbook of Labor Statistics, ILO, (hourly wages in manufacturing)

In particular, the existence of occupations where there is no male-comparison creates some difficulties in comparing jobs in segregated fields (ie. secretaries, office work, etc.). These sex differences in occupational distribution are unaffected by the *equal pay for equal work* principle, and predominantly female-type jobs typically pay less then predominantly male jobs.

The above considerations have generated much debate concerning the desirability of establishing "Comparable Worth" (CW) criteria for setting wage rates[3]. In other words, the concept of *remuneration for work of equal value* characterizes the CW criteria, where equal value may be established by a job-classification system or the like[4]. Alternatively, if women are systematically excluded from many occupations

[3] For a detailed treatment on the concept of "Comparable Worth" see, Goodman (1984).

[4] It is quite obvious that the "job evaluation" process can be somehow problematical. In other words, the *fairness* of the choice of relevant factors and the weights attributed to them could be rather arbitrary.

through employer practices (ie. limited access to jobs and promotion), then "Affirmative Action" (AA) type of policies might be more appropriate. In this case, a specific proportion of women should be found in each occupation.

It has to be said that Italy, being a member of the EEC, is subject to the treaty of Rome, and therefore to the "Equal Pay Directive" (1975) and to the "Equal Treatment Directive" (1976). Yet, despite the formal adoption of the two directives their enforcement has been rare. Subsequent legislation, namely law N.903 (1977) and law N.863 (1984), focused on the implementation of equal treatment in all conditions of work[5].

Despite the importance of these issues for economic efficiency and social fairness, in Italy there has been very little empirical work done in this area. One main reason can be found in the lack of micro-data sets on individual earnings. This chapter builds both on the evidence discussed above and also on the results obtained in the previous chapters, where a significant pay difference was detected among male and female workers even after controlling for a wide range of personal characteristics. In particular, it addresses the issue of wage gender discrimination in Italian industry. The objectives of the present study are twofold. Firstly, to analyze the determinants of wages for both men and women; secondly, to estimate the extent of gender discrimination. These objectives will be pursued considering both pay discrimination and female occupational intensity. The following section discusses the theoretical implications of gender discrimination and outlines the methodology adopted. Section 3 briefly describes the data set employed. Empirical results for pay discrimination are reported and discussed in section 4. Finally, section 5 summarizes the findings and offers some concluding remarks.

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[5] These two cover various aspects of indirect discrimination, like: access to employment and promotion, access to vocational guidance and training, age limits, leave of absence to look after a child, dismissal, etc.

2. Theoretical Issues and Methodology

The existence and the persistence of discrimination in the labour market between men and women has been difficult to reconcile with "orthodox" economic theory. According to the simple competitive model pay discrimination should, in the long run, be eliminated through the operation of competitive forces[6]. In other words, the additional profits earned by the non-discriminating firms (assuming that males and females are perfect substitutes), in hiring female workers, may act as an incentive for these firms to price out the discriminators in the product market and expand production at the expense of these firms. If a constant cost industry structure[7] is assumed to characterize the long-run equilibrium, then the equilibrium outcome will be where non-discriminating firms are the only ones left in the market. Nevertheless, persistent discrimination can be rationalized in terms of tastes of employers, employees or organizations like trade unions and management associations.

A number of competing theories attempt to explain the observed fact of discrimination between men and women, either focusing on *supply side factors* (ie. heterogeneous preferences of workers), or *demand side factors* (ie. employer's preferences for men). Amongst the former, human capital theory (Becker, 1975, 1985), represents the most extensive effort directed towards an explanation of wage determination. In what follows we shall consider two extensions of the basic model. When workers have heterogeneous tastes for job characteristics and the distribution of these differs between men and women, then such differentials in taste produce sex differences in occupational distribution. Furthermore, if the resulting occupational distribution is such that it generates queues into the female intensive occupations, then these occupations would pay relatively lower wages[8].

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[6] This clearly assumes the existence of homogeneous preferences, perfect labour mobility and perfect capital markets.

[7] The result is contingent on a constant cost industry assumption. In a context of increasing costs there is no guarantee that a discriminating cost differential would persist in order to be exploited to the benefit of the non-discriminating firms.

[8] See Killingsworth (1986) for a formal analysis of the model.

Polachek (1980), reaches similar conclusions considering the possibility of heterogeneous human capital investments. In this framework, differences in average female to male earnings are explained by females choosing those occupations where *atrophy*[9] (or skill depreciation) rates are lowest. In other words, given that intermittent participation of women (in the labour market) has adverse effects on earnings' potential, and that re-entry earnings' levels are lower than what they would have been if one worked continuously, then women seek to minimize this loss by choosing those occupations where absences from the labour market are unimportant. It follows, according to these views, that earnings' differentials and differences in occupational distribution of males and females are nothing else than the result of an optimal choice of individual workers.

An alternative explanation, based on demand side explanations, focuses on employers imposing restrictions on recruitment of women into jobs with high wages and high skill acquisition rates[10]. This approach derives its basic idea from the long-standing tradition of the "dual-labour market" and "segmentation" literature (Doeringer and Piore, 1971). Since female access to "primary" type jobs is blocked, a large concentration of women is found in the "secondary" job market where returns to labour force experience and education are lower or non-existent[11]. Furthermore, the excess supply of females to the "secondary" labour market ensures a low wage. Recently, Bulow and Summers (1986) developed an "efficiency wage" model where group differences (ie. between men and women), unrelated to productivity, give rise to wage discrimination and occupational segregation[12].

As far as the present chapter is concerned, no attempt will be made to discriminate between these competing explanations of the stylized facts. The emphasis, throughout the analysis, will be placed upon estimating the determinants of earnings for men and women, with the objective of quantifying the extent of pay

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[9] *Atrophy* is defined as the loss of earnings potential, that can be attributed to periods of work intermittence.

[10] Promotion practices will have the same effect in this model.

[11] For a definition of "primary" and "secondary" job market, see Doeringer and Piore (1971).

[12] Similar conclusions can be found in Stiglitz (1984).

discrimination for a given set of individual characteristics. However, it should be noted that considering only wage differentials to assess the extent of sex discrimination represents one aspect of the problem as the value placed on the job is only partially reflected in the rate of pecuniary compensation. Other factors may well affect the value of the job, namely: the type of work performed, the riskiness of the job, the career profile etc. Also, a portion of the male-female wage gap may well be due to decisions taken outside the labour market (education, training, etc.). To the extent that differences in wages reflect different job attributes, a compensating differentials equilibrium could be the explanation for the observed differences. On the basis of the information available in the data set the issue of a compensating differential is tackled in the empirical analysis, though no effort has been made to control for non-labour market characteristics.

Finally, the observation that major gender differences in the occupational distribution persist, with predominantly female jobs usually paying less than male jobs, seems to suggest that there is an "undervaluation" of female, as compared with male, jobs. In other words, if the occupational distribution between males and females does have an impact on the wage paid, then some sort of relationship between wage rates and femaleness of an occupation should be observed. This is the presumption underlying the CW proposal for setting wage rates according to an hypothetical "value" of the job. A further issue, which will be addressed in the next chapter, concern s the role of different components of pay over the gender wage gap. The following section contains a description of the methodology here employed.

2.1 Pay Discrimination and Female Occupational Intensity

In terms of a general specification of an earnings equation, wages (or earnings) can be expressed as a function of a set of personal characteristics that

influence earnings. The reduced form equation [1], is assumed to be derived from some underlying structural model of labour supply and demand.

Specifically, we consider the following:

$$W^s_i = f(X^s_i) \qquad [1]$$

where the superscript s refers to the gender of the individual; W_i is the wage of the i^{th} individual, X_i is a vector of personal and job characteristics (ie. education, labour force experience, occupation, industry, etc.). The standard methodology for the calculation of the gender wage discrimination effect, was first suggested by Oaxaca (1973) and exploits the properties of index numbers[13]. This "index number" approach involves the estimation of separate gender wage or earning equations. The calculation of the so-called "unexplained difference" between the two equations is assumed to provide an estimate of discrimination[14]. Since the estimated wage equations are, in general, reduced form it is impossible to disentangle demand and supply side effects[15]. The assignment of omitted factors and measurement errors to the residual renders it impossible *a priori* to establish whether the residual estimate reflects an upper bound or a lower bound discrimination estimate. The *caveats* outlined above should be borne in mind, however, when interpreting the results. Slightly modifying Becker (1971) the discrimination coefficient for each female individual[16] in the sample or population may be expressed as:

$$D_i = (W_i^* - W_i^f)/W_i^f \qquad [2]$$

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[13] Cain (1986) in his discrimination survey cites twenty US studies of race and gender discrimination that use this particular methodology.

[14] Although it is common in the literature to refer to the discrimination coefficient as "residual" or "unexplained difference" this terminology might not be totally appropriate.

[15] Since discrimination is ultimately a demand side phenomenon the interpretation of the residual as a discrimination effect relies on the strong assumption of supply side neutrality.

[16] The D_i's could also be validly interpreted for the males in the sample or population. However, under the assumption to be subsequently laid out in the chapter, this would by definition be zero for each male in the sample or population.

where, D_i is the i^{th} female's discrimination coefficient, W_i^* is the i^{th} female's discrimination-free wage and W_i^f is the i^{th} female's actual wage. $D_i=0$ if discrimination is absent. The female wage/earnings equation may be expressed as:

$$W_i^f = exp(X_i^f \beta^f) \qquad [3]$$

The corresponding male wage/earnings equation is given by:

$$W_i^m = exp(X_i^m \beta^m) \qquad [4]$$

where the X_i's are vectors of conditioning variables for each i^{th} individual and β is a vector of unknown parameters. Re-writing [2] gives:

$$1 + D_i = W_i^* / W_i^f \qquad [5]$$

If in the absence of discrimination a male wage/earnings structure is assumed, W_i^* may be simulated for each female in the population or sample on the basis of the β^m coefficients and the female realizations of the X vector of characteristics. This simulated wage can, under the assumption set out above, be interpreted as a discrimination-free female wage. Taking logs of [5] and using [3] and [4]:

$$ln(1 + D_i) = X_i^f \beta^m - X_i^f \beta^f \qquad [6]$$

or more compactly,

$$ln(1 + D_i) = X_i^f \Delta \beta \qquad [7]$$

where $\Delta \beta = \beta^m - \beta^f$. Thus for each individual in the population or sample a discrimination coefficient can be estimated. For the males this, will of course, be zero but for the females the magnitude of the discrimination effect is determined by the differential in payment for a given set of productivity and job characteristics. The

vector of β coefficients for both males and females can be estimated by OLS and as a summary statistic the discrimination coefficient can be evaluated at the means of the data. Thus [7] can be re-expressed as:

$$1/N_f(\sum_i \ln(1 + D_i)) = 1/N_f(\sum_i X_i^f \Delta \beta) \qquad [8]$$

where N_f is the number of female individuals in the sample. The empirical counterpart for the mean expression can now be formulated as:

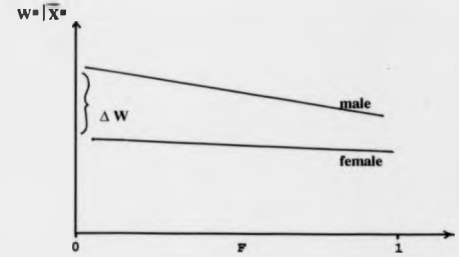
$$\tilde{\mu} = \bar{X}^f \Delta \hat{\beta} \qquad [9]$$

where $\Delta \hat{\beta}$ is the difference between the male and female OLS coefficient estimates[17]. However, if the female character of the job/occupation plays a role in the wage determination process, then it seems plausible to expect a relationship between an individual's earning and the fraction of workers in the job who are women (ie. femaleness of the job). In other words, following the CW issue, we let F be the variable proxying for the value or worth attached to a job/occupation. The more females in a given job/occupation the more undervalued is that job/occupation likely to be, this implies: $\partial W/\partial F < 0$.[18] Johnson and Solon (1984), posit the relationship in terms of the following diagram.

[17] D, the mean discrimination coefficient, may be interpreted as: $exp(\bar{X}^f \Delta \hat{\beta}) - 1$.

[18] It should be noted that there are no reasons *a priori* to expect the two F-schedules to have the same slope. Empirical evidence (Johnson and Solon, 1984), in fact, suggests that the effect is likely to be more pronounced for men than women.

Figure 2 - Wage-Femaleness Relationship



where the vertical axis measures the average log wage rates for men and women given their average values of the *X*'s, while the horizontal axis report female intensity in the job occupation. Figure 2 has the following implications: when $F = 0$, so that a male wage structure is considered, the vertical gap between the two schedules (ΔW) measures average pay differences as net of personal characteristics ($\bar{X}$'s). However, for positive F even if $W=0$ and the two schedules coincide, as in the absence of pay discrimination, women would still receive on average lower pay if they tend to be concentrated in occupations with high female intensity. In practice, in order to ascertain the potential impact of the "femaleness", of the job/occupation, on the wage of the individual, the F term (ie. proportion of women in each job/occupation) has to be entered into the wage equation. The inclusion of the F term has implications for the computation of the discrimination coefficient, which now has to be expanded as follows: from [9] above we have,

$$\bar{\mu} = \bar{X}^f \Delta \hat{\beta} + \bar{F}^f \Delta \hat{\tau} \qquad [10]$$

The first term in the above expression reflects the portion of the mean wage differential due to the existence of differing coefficients, given the same set of

characteristics and holding F constant, the latter term represents the effect of female occupational intensity. Thus varying F^f provides an interesting insight into how the mean discrimination effect alters in response to an increase in female occupational intensity. The mean and base discrimination effects are, however, calculated initially on the basis of assuming F^f equal zero - ie. assuming an exclusively male occupational structure. The calculation of the asymptotic standard errors can be expressed:

$$var(\bar{\mu}) = \bar{X}^f \hat{V} \bar{X}^f \qquad [11]$$

where *var()* is the variance and,

$$\hat{V} = var\,\hat{\beta}^m + var\,\hat{\beta}^f \qquad [12]$$

Since $\hat{\beta}^m$ and $\hat{\beta}^f$ are estimated from separate non-overlapping samples, no covariance exists between them. The asymptotic standard error is thus given by $\sqrt{var(\mu)}$[19].

3. Data

The data set employed in the empirical analysis is obtained from a survey (ENI-IRI) which contains information at the individual level on gross remunerations and employees' characteristics in Italian industry. The total number of full-time workers sampled was 22,795 divided across 7 industries and 89 narrowly defined occupations. The survey refers to occupational levels and occupational structure, of the firms sampled, as of 31st October 1985 [20]. Before turning to the results section some particular features of the survey, relevant to this chapter, will be discussed and their potential implications for the estimation procedure considered.

[19] The resultant test statistic is normally distributed.

[20] Further details on the characteristics of the survey can be found in chapter one. See also: ENI-IRI (1985).

a) All the individuals contained in the survey are covered by collective bargaining agreements. This homogeneous feature of the data set is particularly attractive, since the estimated differential is not likely to be affected by the union/non-union differential. However, in the light of trade union practices, this would imply a smaller differential between sexes than which would occur in the non-union sector[21];

b) the survey does not contain information on some important personal characteristics of workers (ie. marital status, number of children, and location) whose omission could represent a source of potential bias in the estimates. However, information concerning job attributes are controlled for in order to isolate the potential effects (if any) of compensating wage differentials;

c) women might be under-represented in the present sample as it excludes the service sector where women are typically employed;

d) the wage variable is proxied by the gross actual remuneration. This includes all forms of compensation received by the individual in the year according to the normal working time (for each sector); it excludes family allowances and occasional payments. This is at variance with Becker's original analysis which was set in termsof net hourly wages;

e) the variable measuring labour experience refers to *potential* rather than *actual* experience [22]. A measurement error is likely to be found for those individuals with intermittent participation in the labour market (ie. married women, individuals who experienced long unemployment spells or serious illness)[23]. However, this *caveat* is common to most similar studies (see, Oaxaca, 1973; Greenhalgh, 1980);

The definition of variables and their respective means for both the male and female sub-samples are reported in the appendix.

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21 Nickell (1977) provides evidence for the UK on the union mark-up for females. His results suggest that the mark-up is much larger for females than males, implying that the male/female differential is lower for unionized workers.

22 See appendix for details on how it is computed.

23 Zabalza and Arrufat (1985), discuss the limitations associated with the use of potential experience as opposed to actual experience.

4. Empirical Results

In this section we present the main set of results obtained in applying the methodology previously described. Tables 1 and 2 record the parameter estimates for the male and female equations. These estimates are used to calculate wage differentials. In term of the human capital variables (education and labour experience), the returns to an additional period of education appear to be slightly higher for the females than for the males (3.9% as opposed to 3.6%)[24]. These estimated returns are relatively low, as compared to the standard results obtained from human capital empirical studies. This, however, may be due to the inclusion of occupational controls. The possession of a formal educational qualification is, in many cases, a pre-requisite for admission to certain occupations. Variables controlling for job characteristics and firm size, have also been included in the analysis. The coefficients on the characteristics of the job provide some information on the effects of job responsibility, and working conditions on individual wages. The results of tables 1 and 2 show that females receive higher returns, relative to the base, for supervising than males[25]. Women receive, *ceteris paribus*, 18.8% more than non-supervising women, while men receive 8% more than non-supervising men[26].

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24 The inclusion of educational dummies (ie. EDUC1=degree, EDUC2=high school, EDUC3=intermediate, else compulsory school) in the earnings equation, instead of the formulation presented in the appendix, generated the following results (all significant at the 1% level):

(female eq.) 0.3882 EDUC1 + 0.1530 EDUC2 + 0.0427 EDUC3
(male eq.) 0.3762 EDUC1 + 0.1713 EDUC2 - 0.0181 EDUC3

Despite a puzzling negative sign in the male specification, the results seem to suggest the existence of increasing returns from education with the biggest return recorded for those individuals possessing a university degree.

25 Note that this should not be interpreted as females receiving more on average than males for their supervising responsibilities.

26 Since the proportion of females in the supervising category is relatively small (4.7%) as compared to males (30.8%), some care should be taken in interpreting the results.

Table 1. - Estimated Coefficients for the Male Wage Equation

(dependent variable is the logarithm of actual gross remuneration)

variables	*coefficients*	*ASE$*
Female occupational intensity		
F	-0.32207	(0.02420)
Personal characteristics		
EDUC	0.03552	(0.00123)
EXPER	0.01492	(0.00086)
EXPER^2	-0.00020	(0.00001)
Occupation		
PRO_TECH	0.15669	(0.01015)
MAN_ADM	0.20648	(0.01052)
CLERICAL	0.25581	(0.01389)
CRAFTS	0.02617	(0.00598)
OPERATIVES	0.01860	(0.00594)
Industry		
MECH	0.04099	(0.00886)
METAL	0.02532	(0.01077)
PETR	0.17497	(0.00946)
CHEM	0.09607	(0.00900)
FOOD	0.11906	(0.01633)
MISC	0.06081	(0.00686)
Job characteristics		
WORK_COND	0.01403	(0.00281)
SUPER	0.07706	(0.00333)
FIRMSIZ_2	0.01146	(0.00459)
FIRMSIZ_3	0.00069	(0.00468)
constant	9.14560	(0.01230)

Diagnostic tests

R^2	0.58
SE of Reg.	0.018
Heteroscedasticity	
(i) χ^2(RHS)	68.7
Functional form	
(ii) $\chi^2(2)$=5.9	8.2
RHS variables	20
N. observations	18,549

note: A full description of the variables and their meaning is contained in the appendix.
$ heteroscedastic-consistent asymptotic standard errors (ASE) in parentheses (White, 1980).
(i) The test for heteroscedasticity is Breush and Pagan's (1979) test, and it is distributed as $\chi^2(p-1)$ where p is the number of estimated parameters in the model.
(ii) The test for functional form is Ramsey's (1969) RESET test, it is a $\chi^2(2)$ test of the significance of the squared and cubes of the fitted values in each model.

Table 2. - Estimated Coefficients for the Female Wage Equation.

(dependent variable is the logarithm of actual gross remuneration)

variables	*coefficients*	*ASE*
Female occupational intensity		
F	0.01902	(0.00896)
Personal characterstics		
EDUC	0.03929	(0.00125)
EXPER	0.01486	(0.00087)
EXPER^2	-0.00019	(0.00002)
Occupation		
PRO_TECH	0.13124	(0.01066)
MAN_ADM	0.14441	(0.01327)
CLERICAL	0.15077	(0.01230)
CRAFTS	0.08330	(0.02600)
OPERATIVES	0.06878	(0.01213)
Industry		
MECH	0.05546	(0.00588)
METAL	0.07322	(0.01045)
PETR	0.17586	(0.00698)
CHEM	0.10443	(0.00634)
FOOD	0.14752	(0.01190)
MISC	0.09137	(0.00699)
Job characteristics		
WORK_COND	0.07383	(0.00873)
SUPER	0.17266	(0.00854)
FIRMSIZ_2	0.01907	(0.00479)
FIRMSIZ_3	0.00372	(0.00494)
constant	8.99894	(0.01821)
Diagnostic tests		
-R^2	0.57	
-SE of Reg.	0.020	
-Heteroscedasticity (i) $\chi^2(20)$	66.1	
-Functional form (ii) $\chi^2(2)=5.9$	9.2	
-RHS variables	20	
-N. observations	4,223	

note: See table 1

Controlling for work conditions (ie. in particular, whether an individual works with machines), produced no evidence for the existence of compensating wage differentials[27]. This is consistent with the evidence contained in chapter three where differentials were found to be additive rather than compensative[28]. In this respect, female job-attributes differentials (with respect to the reference group) appear to be significantly wider than for men (ie. 7.7% for women, as opposed to 1.4% for men). The firm size coefficients do not show any recognizable pattern. Though the coefficient estimates are, as a group, statistically significant, the magnitude of the difference between the included category and the reference group is never much greater (and sometimes less) than 1% for either of the sexes. The compensating differentials assumed to accrue to larger sized firms is not observed here; this, however, might be due to the non-existence of significantly small sized firms in the base group. The coefficients on the occupation and the industry dummy variables, provide an interesting insight into wage differences associated with being present in an occupation or industry category[29]. A contrast across gender may prove useful. The biggest differential for male workers, in terms of occupations, is the managers-administrative occupational category. This is not the case for female workers where the largest differential appears in the clerical occupational category. In terms of all the other occupational categories, the differentials are relatively wider for the males, with respect to the labourers reference group, than is the case for the females. The lowest ranking occupational category for both males and females is the labourers group.

The petrol category is the top-ranking industry category for both males and females, similarly the reference group textiles is at the bottom of the scale for both sexes.

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[27] Brown (1980) and Rosen (1986), discuss the compensating differential approach and provide an exhaustive survey of the empirical literature.

[28] When job-attribute controls are considered, in order to assess whether the differentials can be the result of a compensation for particular undesirable charactersitics of the job (bad-job), their impact on wages does not contribute towards a reduction in unexplained wage differentials. Conversely, the estimated wage structure suggests that positive wage premia are associated (add up) to good-jobs, while no compensation for bad-job attributes appears.

[29] It should be noted that this procedure considers the allocation of workers to different occupations and industries as a random drawing. If this is not the case problems of selection bias may arise.

Finally, some comments concerning the CW issue are in order. The coefficient on the ***F*** term is designed to capture the worth attached to a job/occupation[30]. The male wage equation seems to confirm the existence of a significant negative relationship between the proportion of females and the wage paid. The pronounced negative effect recorded by the male coefficient suggests that, in terms of wages, males in female intensive jobs are - *ceteris paribus* - worse off than other males[31]. Conversely, the female coefficient implies a relatively flat female wage profile in terms of the ***F*** term. In other words, females do not appear to experience a negative impact on wages (as female occupational intensity increases) as experienced by males.

In conclusion, the female intensity of the job/occupation seems to play an important role as far as wage determination is concerned; moreover, if the observed occupational distribution reflects some form of discrimination by gender, then a different impact on wages of the female occupational intensity term, across genders, should be expected.

4.1. Estimates of Gender Discrimination

This section focuses on the estimates of the unexplained differential following the methodology outlined in section 2. The discrimination coefficient is from [10] stated as:

$$\bar{\mu} = \bar{X}^f \Delta \hat{\beta} + \bar{F}^f \Delta \hat{\tau} \qquad [10']$$

The above expression will be our main concern in the following analysis. The results presented in this section will firstly concentrate on pure wage discrimination,

[30] Although the present analysis treats the gender occupational distribution as being exogenous relative to wage determination, nevertheless it could be argued that female occupational intensity (**F**) is not independent from the observed wage.

[31] This is in accordance with the findings of Johnson and Solon (1984) for the US.

assuming a male wage structure (which in turn implies setting the F term to zero). Later, this assumption will be relaxed and the impact of the F^f term, on the discrimination coefficient, will be considered (see equation [10'] above). Estimates of the unexplained portions of the observed differential, together with the appropriate standard errors can be calculated. However, examining the average may provide a misleading picture of how the differential behaves across different categories of individuals. Table 3 reports differentials calculated on the basis of a reference set of characteristics, and on the basis of deviations from this reference set.

Table 3. - Estimates of Wage Discrimination Coefficients for Different Types of Stylized Individuals

Characteristics	*D*	*ASE of D*
MEAN	0.1685	(0.0184)
BASE	0.1656	(0.0185)
Occupation		
PRO_TECH	0.1956	(0.0182)
MAN_ADM	0.2356	(0.0185)
CLERICAL	0.1908	(0.0191)
CRAFTS	0.0127	(0.0154)
OPERATIVES	0.0213	(0.0160)
Industry		
MECH	0.0650	(0.0167)
METAL	0.0304	(0.0167)
PETR	0.0801	(0.0168)
CHEM	0.0739	(0.0166)
FOOD	0.0558	(0.0168)
MISC	0.0585	(0.0166)
Job characteristics		
WORK_COND	0.0308	(0.0166)
SUPER	-0.0015	(0.0160)
FIRMSIZ_2	0.0941	(0.0167)
FIRMSIZ_3	0.1004	(0.0167)

note: See table 1.

The reference set is defined as a hypothetical female worker with mean labour force experience, mean education, belonging to the labourer occupational category, in the textile industry, working in the smallest sized firm, with a machine, being strictly

supervised and assuming an exclusively male occupation. The unexplained wage differential, in this case, is over 16% suggesting that females are worse off in terms of this particular set of characteristics.

The deviations from the base[32] allow the effects of the differential to be isolated in terms of the different categories. Asymptotic standard errors are also reported to establish statistical significance. As is evident from table 3, the widest differentials are in terms of the occupational categories ranging from 1% to a little under 24% for craft workers and manager-administrator employees respectively. Conversely, the inter-industry differentials are much narrower ranging from 3.1% in the metal category, to 8% in the petrol category. Unexplained wage differentials in terms of the job characteristics (ie. working conditions, supervision, firm size , etc.), are relatively small. A bigger unexplained differential is reported for larger sized firms as compared to smaller sized ones. Particular care should be used in interpreting the negative sign on the supervision coefficient as it lacks statistical significance. Table 3 clearly illustrates that the greater weight of the unexplained differential lies in term of the occupational categories. The existence of vast differentials, within occupational categories, may be indicative of dual labour market structures operating across and within given occupations. Discrimination appears to be strongest in white collar jobs as females are anchored in the lower parts of an albeit broadly defined occupational structure, where access to promotion and career advancement is blocked. Males, on the other hand, do not encounter such barriers and achieve higher levels within a given structure, thus leading to the vast intra-occupational differentials observed in table 3.[33]

Turning to the second issue, that is how female intensity in the job/occupation affects the wage, we now relax the assumption of an exclusively male occupational structure and consider the implications for the discrimination coefficient as female intensity increases. Since the unexplained gender wage gaps are narrower in those

[32] The term "base" and "reference set" are used in the text inter-changeably.

[33] Brown, Moon and Zoloth (1980), using a different methodology reach similar results, namely that: a substantial discrimination effect occurs through within-occupations segregation of women.

occupations where females are well represented, one would anticipate a decline in the unexplained wage gaps as female occupational representation increases. The calculations based on this exercise are reported below. Table 4 presents the estimates of the discrimination coefficient as the ***F*** term varies. When we consider a predominantly male occupational structure the wage discrimination coefficient is over 16%, implying that males (other things being equal) have an advantage over females. This advantage dies out when the percentage of females in the job/occupation is over 45% [34], that is, an increase of 5% in female occupational representation generates a reduction in the discrimination coefficient of approximately 2% . Hence, it appears that the relevance of the gender occupational distribution, for the analysis of gender discrimination issues, is non-trivial. However, what has to be explained is why the gender wage gap become smaller as the percentage of females in the job/occupation increases. This can be due to the fact that, in all-male occupations, females are strongly discriminated against, and, as a result, the femaleness of the occupation increases as the level of discrimination goes down[35].

Table 4. - Estimates of Wage Discrimination Coefficients for Different Values of Female Occupational Intensity.

F-term	*D*	*ASE of D*
F=0.00	0.168	(0.0184)
F=0.05	0.148	(0.0178)
F=0.10	0.129	(0.0132)
F=0.15	0.110	(0.0170)
F=0.20	0.091	(0.0167)
F=0.25	0.073	(0.0164)
F=0.30	0.054	(0.0161)
F=0.35	0.037	(0.0158)
F=0.40	0.019	(0.0158)
F=0.45	0.002	(0.0155)
F=0.50	-0.013	(0.0153)

note: See table 1.

[34] Rather interestingly, it could be observed that simulating the unexplained wage differential in an hypothetical female occupational structure a negative discrimination coefficient would be observed.

[35] The term discrimination here is used in a general sense and should be interpreted as to encompass all forms of job segregation and restrictions to promotions.

Since all-male occupations have higher discrimination coefficients (ie. that is why they are all-male), females tend to go to those occupations with the lower discrimination coefficients. Given that there exists a distribution of discrimination coefficients across occupations, if women enter those occupations with high male representation (these could be interpreted as having high discrimination coefficients) they will experience, on average, lower wages. In other words, differentials can be wider where males are in a great proportion because they get better prospects, as compared with females (of identical characteristics), in terms of job opportunities and career profiles. The discriminating employer will select males for the higher positions in the occupational hierarchy while segregating females in low paid jobs. This is consistent with a dual labour market interpretation.

However, it should be noted that our findings could also be consistent with the heterogeneous preference hypothesis. In fact, if the job/occupation where females tend to be concentrated is indeed characterized by various attributes, unrelated to the worker's productivity, which affect individual utility and make the job particularly valuable - on average - to female workers; then, the unexplained differential would merely represent unobserved characteristics related to the worker/job match. This is an open question which should be addressed in future research using structural models to discriminate between competing explanations.

5. Concluding Remarks

The analysis presented in this chapter has attempted to shed some light, in the context of the Italian labour market, on wage based gender discrimination effects and on the potential impact of gender occupational distribution on wage determination. The results obtained, provide some useful insights for Equal Pay legislation and on

the efficacy of CW type policies. Wage equation estimates are in line with results obtained elsewhere in the literature. In general the coefficients possess the correct *a priori* signs and are of a reasonable magnitude. A discrimination effect of nearly 17% resulted when an exclusively male occupational structure was considered. The gender wage gap was showed to decrease as female intensity increased. In terms of the framework used, two competing interpretations have been proposed and their implications discussed. In particular, it seems straightforward to see how, on welfare grounds, the desirable policy measures will differ in each of the two cases. Intuitively, if the observed differences in average pay and occupational distribution are the result of voluntary choices, then the wage structure cannot be improved by legislative action. The relative wage changes, resulting from any anti-discrimination policy, would be undesirable on welfare grounds. Conversely, if women are systematically excluded from certain occupations, and segregated instead into occupations characterized by depressed wage rates[36], legislative intervention might then be advocated on welfare grounds. Let briefly consider the implication of two different policy measures which, in recent years, generated much discussion among scholars and in political arenas, namely: Comparable Worth (CW) and Affirmative Action (AA) policies. The implementation of a CW type policy will tend to reduce the impact of the F-term on wages. However, if non-productivity related differences between the male and the female groups (ie. different separation rates, shorter expected working horizon, etc.) exist, these will most probably affect employers' behaviour in the selection process as well as the wage paid. If this is the case, then any anti-discriminatory policy attempting to raise the "value" of some occupational categories above the market level, might have adverse effects. In particular, this could take the form of an increasing segregation within any given occupation (of comparable value) towards the lowest and worse paid positions. This reinforces our previous finding, namely that pay discrimination occurs mainly in terms of

[36] This originates from the fact that female intensive occupations are undervalued relative to male intensive occupations.

occupational differences. Alternatively, AA policies could represent a valid remedy to the problem of occupational segregation. Such a policy would involve a specific proportion of women being allowed into male intensive occupations. This, in turn, modifying directly the occupational distribution, could, *ceteris paribus*, reduce the earnings' differential.

In conclusion, the agenda for future research should first include a structural analysis of discrimination capable of discriminating between competing models, and secondly should extend the analysis of the effects of discrimination to a general equilibrium framework.

APPENDIX

Table A1. - Variable Definitions and their Means (both samples)

variable	*description*	*mean*	
		male	*female*
WAGE	logarithm of gross actual yearly earnings,(*1000 liras)	10.016	9.922
EDUC	education (years) - compulsory school=8 - intermediate=10 - high school=13 - degree=17	11.990	11.887
EXPER	potential experience (years), defined as : (age - EDUC - 6)	22.904	18.863
F	female occupational intensity (fraction of workers in the job who are women) - 89 different occupational categories	0.081	0.643
# SIZ_1	firm size, defined : (number employees) - 0<firm<999	0.141	0.150
# SIZ_2	- 1000<firm<5000	0.467	0.489
# SIZ_3	- 5000 and over	0.392	0.361
# SUPER	monitoring (if supervised on the job=0, otherwise=1)	0.308	0.047
# WRKCON	working conditions (if working with machines=0, otherwise=1)	0.256	0.085
# PRO_TECH	professional and technicians	0.347	0.088
# MAN_ADM	managers and administrators	0.083	0.066
# CLERIC	clerical	0.092	0.765
# CRAFTS	craft workers	0.300	0.003
# OPERAT	operatives	0.142	0.032
# LABOUR	labourers	0.036	0.046
# MECH	fabricated metal and machinery.	0.445	0.427
# METAL	primary metals	0.019	0.012
# PETR	petroleum	0.106	0.096
# CHEM	chemical	0.268	0.206
# TEXT	textile	0.037	0.065
# FOOD	food	0.013	0.022
# MISC	other manufacturing industries	0.112	0.171
number of observations		18,549	4,223

note: # denotes a dichotomous variable. The mean of the dummy variables can be interpreted as the relative proportion in the sample.

CHAPTER SIX

Wage Drift in Two-stage Wage Determination Systems

1. Introduction

Wage formation is characterised by a two-stage procedure in several European countries. In the first stage, negotiations between trade unions and employer associations set a wage level which can be subsequently modified, in the second stage, by overpayment at the firm level. This second stage originates the so-called wage drift[1]. The drift, itself, is partly the result of further bargaining occurring at the firm level between the employer and a local union, and partly due to unilateral payments made by the firm to individual workers.

In the last ten years, both the size and the diffusion of wage drift have become increasingly important in shaping pay levels. The progressive decentralization in pay formation appears to be common not only in countries characterised by industry-wide settlements, but also in "corporatist" countries; which traditionally have been regarded as having both high centralisation and a high level of consensus in wage setting. For example, with particular reference to the manufacturing industry, in Scandinavian countries wage drift accounts for nearly 40% of actual remunerations (Holden, 1989; Holmlund and Skedinger, 1988; Calmfors and Forslund, 1989), while in Austria, in

[1] Wage drift is generally considered a dynamic concept, ie. wage increases in addition to wage changes agreed upon in collective negotiations. However, in the present work, we shall refer to the drift as any deviation of the actual wage from the collectively bargained wage levels.

the last decade, wage drift has contributed to approximately 20% of total wage increases (Deutsch, 1990). A similar pattern can be found in Italy where the share of the drift on total remuneration is, on average, over 20% (Asap, 1988).

In general, it can be observed that the shift in pay system practices experienced, by several countries, in the last decade - in the search for greater flexibility in work organization and in labour costs - has determined a move towards an increasing individualisation of wage levels (Blissett and Sisson, 1989; Mason and Terry, 1990). These facts call for an explanation. Indeed it may prove interesting to analyse why firms are prepared to pay wage premia on top of the centrally negotiated levels. One hypothesis worth investigating lies in the effects that overpayments exert on labour productivity. Moreover, it might also be the case that the drift mechanism will have an impact on the wage structure.

This paper attempts to address both issues in the context of the Italian economy. First, the impact of overpayments on labour productivity is tested using time series aggregate data for the metal-mechanical industry. Second, the role of wage premia in shaping pay levels is analysed using cross-section individual level data for the same industry. The paper is organised as follows. In the next section the theoretical implications of wage drift are discussed and a framework for the analysis is developed. Section 3, introduces the empirical part. Section 3.1 presents an empirical specification, suitable for estimation, of the wage drift-productivity relationship. The main results are discussed therein. In section 3.2 a structural wage equation for the analysis of the wage drift is estimated and the results discussed. Finally some concluding remarks are contained in the last section.

2. The Theoretical Model

When the wage determination process follows a two-stage procedure, one obvious question concerns what is settled in the final stage and how this is related to the outcome of the first stage. This phenomenon has important implications for wage formation, in fact large overpayments might well work so as to offset the pattern of pay levels settled by collective bargaining. Given the particular nature of the wage drift, one could reasonably expect that its influence will affect not only the aggregate wage but also the pattern of relative wages. The extent of the drift is likely to differ among firms and for various types of labour. Also, while bargaining outcomes usually follow some egalitarian principle and are targeted towards the low-paid employees, the pattern of overpayments set by the firm shows that high-paid employees mainly benefit from them. There are several reasons why firms might find it profitable to pay wage premia to some group of workers.

Traditionally, the existence of a wage drift has been related to the presence of payment by result schemes and to the need of reallocating the labour force so as to eliminate imbalances between supply and demand. An extensive literature on wage drift flourished in the 60s. Wage drift, given the prevalence of full employment conditions in most countries, was then seen as a major problem for the efficacy of incomes policies. Probably due to this reason the problem was mainly seen as a demand side effect and cast in terms of labour shortages (Marquand, 1960; Rehn, 1959). Nevertheless, some studies looked for further explanations. For example, Phelps Brown (1962) in a seminal study reported that among the reasons frequently advanced by managers and unionists as to what were the causes of the drift, there were both the search for greater effort by the workers, and the need - for fairness considerations - of restoring customary relativities. In particular, the same author, proposed a distinction between primary and secondary drift: where the former is motivated by labour shortages and productivity reasons, while the latter emphasises the importance of wage relativities. Lerner and Marquand (1962), in an accurate field-

work study on workshop bargaining in the British engineering industry, came to similar conclusions. They also stressed the relevance of non-demand determined wage drift mechanisms, such as: merit rates - to reduce turnover and retain experienced labour -, personal and lieu rates - to minimise discontent and enhance work effort.

A recent renewal of interest on the role of wage drift has mainly concentrated on the incentive role of overpayments[2]. This is not surprising given the high level of unemployment experienced by European countries in the last decade[3]. Incentive schemes, as already suggested in some of the old literature, are widely used by firms to obtain higher effort or to reduce turnover. In this light, the extensive literature on efficiency wages (EW) can provide the theoretical underpinnings for the analysis of wage drift (Akerlof and Yellen, 1986). The basic idea, underlying this class of models, is that there is a relationship between the wage paid by the firm and employees' productivity.

A number of reasons are proposed in the literature to explain why output might depend on the wage paid: high wages may increase morale and therefore the productivity of workers (Akerlof, 1982, 1984), they can lower turnover costs reducing quits (Salop, 1979; Stiglitz, 1985), deter shirking (Shapiro and Stiglitz, 1984; Bulow and Summers, 1986) or attract workers with higher quality, when this is imperfectly observed (Weiss, 1980).

In this paper, wage drift is considered as an attempt by firms to optimally fix wage levels so as to enhance productivity of workers. In this respect, although part of the drift is the result of further collective bargaining at the firm level, we will be mainly concerned with the component of the drift which is unilaterally paid by the firm to individual workers and does not originate from any rent-sharing mechanism[4].

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[2] For an extensive treatment of firms' compensation policies and incentive schemes, see the special issue of the *Industrial and Labor Relation Review*, Vol.49, N.3, 1990.

[3] For a different interpretation of wage drift see, Isachsen (1977), Holmlund (1986) and Calmfors and Driffil (1988).

[4] It has to be noted that other theories can be seen as providing a rationale for the payment of wage premia: for example, insiders-outsiders theories (Lindbeck and Snower, 1986a,b). However, if the pattern of wage drifts merely reflects some implicit rent-sharing between the employer and individual workers - as suggested by the insiders-outsiders explanation - then, there should be no direct effects on productivity.

Firms take as given the wage resulting from the bargaining process (ie. central and local negotiation) and optimally adjust the size of the drift to maximise profits. The drift can be positive or zero, but not negative as the wage level resulting from negotiation cannot be undercut. However, it has to be noted that, if the pattern of negotiated wage levels is totally undone by the drift mechanism, then firms can be thought as having complete discretion in setting wage levels. This case is close to the "standard" efficiency wage model where only the actual wage level matters (Solow, 1979). In other words, if wage bargaining is targeted towards a reduction of differentials, while the wage drift is chosen by firms so as to re-establish some customary wage relativities; then ultimately what matters, in this case, is the firms' wage setting behaviour. Conversely, if the individual drift is chosen as a wage premium relative to the negotiated level (but not necessarily proportional to it), then the latter has a role on its own to play. We shall refer to this as the "drift-effect" model.

In general, workers will not be indifferent to overpayments as compared to higher negotiated wage levels. In other words, it can be reasonably argued that when overpayments take the form of merit-pay or incentive premia, these will be - *ceteris paribus* - strictly preferred to comparable increases coming through collective bargaining[5]. Also, if wage levels from collective bargaining imply smaller incentive premia, it might turn out that negotiated wage levels have a negative impact on effort and therefore on labour productivity.

Finally, from the firm's point of view, the possibility of using the drift payment for screening and monitoring purposes is greatly reduced by a higher negotiated wage level.

In what follows, we develop a simple extension of the standard EW model - highlighting some of the features previously described - and discuss its implications.

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[5] This can be explained considering that overpayments are aimed to signal status, reputation and skill of individual workers (see Pritchard *et al.* 1972, for some experimental evidence on this issue).

We specify an effort function $e(\cdot)$ in which the personal effort of each individual depends on the extent of the overpayment received (wage drift), measured by the ratio of the actual wage w with respect to the collectively negotiated wage level c[6]. The effort function is strictly increasing and concave in w/c,

$$e = e(w/c) \qquad e'>0 \quad e''<0 \tag{1}$$

For simplicity individuals are assumed to be identical in their effort capacity.

Consider a firm characterised by a short-run production function with fixed capital and labour inputs (L) specified in an effort augmenting fashion $e(\cdot)L$. The technology available to the firm is the following,

$$Y = F(e(w/c)L) \qquad F(0)=0,\ F'>0,\ F''<0 \tag{2}$$

where Y denotes output. In other words, given the number of workers, output is related to the intensity of effort through the incentive effect of the wage drift.

Firms wish to maximise profits (π) choosing wage level and labour inputs. Normalising output prices to 1, so that w and c are expressed in real terms, the profit function can be written as,

$$\pi = Y - wL = F(e(w/c)L) - wL \tag{3}$$

the first order conditions are,

$$\pi_w = F'e'/c\ L - L = 0 \tag{4}$$

$$\pi_L = F'e - w = 0 \tag{5}$$

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[6] The variable c throughout the paper is defined as the outcome of the collective bargaining process, - ie. it includes both the central and the local negotiated levels.

from [4] and [5] we obtain,

$$\frac{we'(\cdot)}{e(\cdot)c} = 1 \qquad [6]$$

which satisfies the standard "Solow" condition, where the elasticity of effort with respect to the wage (drift) is equal to 1. Equations [5] and [6] form the system to be solved for the optimal wage (w^*) and labour inputs (L^*) to the firm.

A structural form wage equation can be derived from [6], in which the drift depends on factors which affect individual productivity (effort),

$$w/c = \psi(Z) \qquad [7]$$

The vector of variables Z, should contain those considerations which push firms to pay wage premia on top of the collectively bargained wage.

It is worth noting that the production function, in this simple model, is defined for a given capital stock, for normal capacity utilisation, and it is assumed that firms are operating on the "production frontier". All these assumptions will be reconsidered in the empirical analysis. Also, since both the level of negotiated wage and the size of the individual drift are likely to differ across individuals according to their skills and the job performed, the assumption of homogeneous labour will be eventually relaxed.

3. The Empirical Model and Results

The theoretical model formulated above addresses two important issues: first, what is the role of overpayments on (labour) productivity and second, what are the characteristics of individual wage premia in an heterogeneous labour pool. Both of these will be dealt with in the following sections. In section 3.1, the hypothesis that

wage premia are paid out by firms to enhance workers' productivity is tested by means of aggregate time series data for the Italian metal-mechanical industry[7]. Individual level cross-section data (for the same sector) are used instead, in section 3.2, to analyse how firms optimally determine wage drift to increase workers' effort, to lower turnover and to deter shirking.

The principal reason why the analysis has been limited to the metal-mechanical industry is the non-availability of data on the composition of pay for other manufacturing industries. This has two main disadvantages: first it prevents us from extending the main findings directly to the rest of the economy; and second, the results could prove idiosyncratic to the industry considered. However, the strength of unions and the importance of restrictive practices in the metal-mechanical industry represent the most unfavourable conditions for the kind of pay flexibility considered here[8]. Therefore, it could be argued, the relevance of individual overpayments in this industry and their relative effects should be regarded as a lower bound estimate if compared with other manufacturing industries. The main features of the data sets employed are briefly discussed in each section[9].

3.1 Wage Drift and Productivity[10]

As discussed at some length in one of the previous chapters, the Italian labour market in the seventies was characterised by rigidities mainly originating from institutional factors. Union behaviour and labour legislation have often been blamed as major causes for the lack of flexibility. As a result, the impact of the oil shocks on economic performance turned out to be particularly severe, both in terms of increased

7 The choice of aggregate data has been imposed by the unavailability of convenient firm level data.
8 Indirect evidence on union power and restrictive practices in this industry have been discussed in chapter 3.
9 A more detailed description of the variables employed and the sources of the data is contained in the Appendix.
10 This section is the result of a joint work with C. Dell'Aringa published in, R. Brunetta and C. Dell'Aringa (eds.), *Labour Relations and Economic Performance*, Macmillan, 1990.

inflation and unemployment. In the early eighties, although unions showed a less conflictual attitude and agreed to the implementation of an incomes policy - which most likely contributed to slow down inflation -, nevertheless, the expected effect on employment and unemployment did not come through, with unemployment keeping its rising trend.

Why did the more favourable circumstances in terms of union wage-push not produce a lower unemployment rate in the 1980s? This chapter cannot provide an exhaustive answer to this issue. However it attempts to shed some light on the factors which might have contributed to keep unemployment high. Our analysis starts from the simple observation that, in the period considered, union concessions in terms of increased flexibility were matched by large increases in labour productivity. Moreover, although real wages kept increasing roughly as much as they did in the previous period, nevertheless the increases were much lower than those in labour productivity. The overall wage moderation expanded the room for manoeuvre of individual firms, who proceeded to grant wage increases to their workers even without being pushed by the union to do so. One possible explanation for the observed relationship which includes decreased union wage-push, greater flexibility, increasing unemployment and high productivity, can be found in the hypothesis that firms were paying wage premia in order to enhance productivity. In other words, what we wish to test, is whether the wage-drift mechanism has been used by employers in an "efficient" way, to enhance labour productivity in order to minimise unit labour cost through higher effort, lower turnover, and so on.

A number of authors have recently produced substantial empirical evidence, for different countries, supporting the hypothesis that firms pay efficiency wages (for the USA: Krueger and Summers, 1987, 1988; Dickens and Katz, 1987a,b; for the UK: Nickell and Wadhwani, 1987, 1988; Wadhwani and Wall, 1988; for Germany: Hübler and Gerlach, 1990; for France: Fitzroy and Vaughan-Whitehead, 1989).

A different strand of the literature has tried to analyse the nature of the drift, originating from decentralized bargaining, and its effects on wage determination and employment (Holmlund and Skedinger, 1988; Holden, 1989; Deutsch, 1990).

In both approaches the maintained hypothesis is that the firm pays a wage which is in excess of the wage in alternative employment; this latter being either the average wage of the industry or the centrally negotiated wage level. The main difference between the two approaches is that: in the EW approach the overpayment is unilaterally set by the firm, while in the bargaining approach it is the result of negotiations with unions at the firm level. Although conceptually the two hypotheses appear quite distinct in practice it may prove difficult (if not impossible) to disentangle the two effects, as the firm might be prepared to pay wage premia as to contain industrial action and reduce the potential losses of a dispute[11] (Dickens, 1986).

In this section, our analysis will be mainly concerned with the effects of that portion of the drift which is unilaterally set by the firm: in the spirit of the EW hypothesis we shall refer to this as the efficiency variable. In practice, the latter has been computed as the difference between total average earnings and collectively bargained wage, and expressed as a percentage on total average earnings. Clearly, the existence of a positive relationship between the wage level and productivity could be attributed to different factors not necessarily related to "efficiency" considerations, these will be discussed below.

The empirical model follows a similar methodology to the one employed in Wadhwani and Wall (1988) and in Stegwee (1990). Starting from [2] we choose a specific functional form for the production function and estimate a Cobb-Douglas specification "augmented" by efficiency wage factors[12]. As the form in which the efficiency variable enters the production function is not obvious, different functional

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[11] There are cases in which the payment of wage premia, to avoid unionization and contain collective action, is explicitly declared by employers (see, "La Repubblica" 19th June 1990).

[12] A Cobb-Douglas specification was preferred to a more general one on the ground of its simplicity and tractability. However a CES production function is also considered.

forms have been considered. In particular we investigated two main hypotheses: the first in which the efficiency term enters in a "neutral" form, as to say in some multiplicative way interacting with the labour factor[13]; the second in which a "non-neutral" form is adopted. In this latter case a specific form for the effort function, as suggested by Akerlof and Yellen (1986), is considered.

In practice, for the "neutral" case, we fitted the following specification :

$$Y_t = A\, K_t^{\alpha}\, W_t^{\delta}\, L_t^{\beta}\, e^{(\gamma t+\varepsilon_t)} \qquad \alpha, \beta, \delta > 0 \qquad [8]$$

where, Y_t is output, K_t the capital stock, L_t the labour factor, t a time trend, A a constant, W_t is the EW variable, and $\varepsilon_t \sim N(0,\sigma^2)$ is the error term. The parameters $\alpha, \beta, \gamma, \delta$ have to be estimated.

In the "non-neutral" case, the elasticity of labour with respect to output (ie. the parameter β), is influenced by the efficiency variable as shown in [9][14].

$$\beta = \beta_0 + \beta_1 W_t \qquad \beta_1 > 0 \qquad [9]$$

In order to test for alternative formulations of the EW hypothesis additional terms have been included both in [8] and [9]. Before turning to the main results, it is necessary to discuss further the estimation procedure employed and what we consider as a "test" for the validity of an EW type model. In practice, a positive sign and a test of significance on the efficiency variable coefficient, is what we used to discriminate against the standard neoclassical model. However, as already mentioned, other reasons unrelated to EW could generate similar results. For example, the presence of workers' "unobserved ability" (Gibbons and Katz, 1989), the existence of "productivity bargaining" procedures (Brown and Nolan, 1988; Blissett and Sisson,

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[13] In a Cobb-Douglas specification this will result "observationally equivalent" to any other shift factor affecting productivity.

[14] Clearly in this case the efficiency term as it is specified in [8] disappears (ie. $\delta=0$).

1989) and of "union-threat" effects (Dickens, 1986), could be considered as alternative explanations for the observed phenomena. We shall discuss them in turn.

First, as far as the "unobserved ability" argument is concerned, we refer to the evidence presented in one of the previous chapters (see chapter 3) to rule out the possibility that some unobserved (to the econometrician) characteristics are responsible for a significant and positive association between wage and productivity. Second, when considering the "productivity bargaining" issue, it seems reasonable to expect that where increasing flexibility is negotiated by the union for a higher wage, this will show up in the collectively bargained wage drift rather than in the individual wage premium set by the firm. However, in the empirical analysis, the introduction of both types of drift (collective and individual) may help to discriminate between the effects on productivity of the two components.

Finally, it appears more difficult to deal with the "union-threat" effect explanation. In fact, although the efficiency premium is recorded as a firm's choice variable, and an appropriate estimator is employed - as to take into account the presence of potential simultaneity bias -, nevertheless it cannot be ruled out that firms merely anticipate "union-threat" effects by paying efficiency premia[15].

A log-linear specification, of the models implied by [8] and [9], was estimated using seasonally unadjusted quarterly data for the Italian metal-mechanical industry. The time period goes from 1974:Q1 up to 1985:Q4. The dependent variable is value added at constant prices. Independent variables included in the basic formulation are: capital services, total employment, an individual efficiency premium, a measure of labour force utilisation (Muellbauer, 1984)[16], a time trend and seasonal dummies. In order to estimate consistently the parameters of the production function, an Instrumental Variable (IV) estimator was implemented and capital services, employment and EW variables were treated as endogenous[17].

[15] However in this case, as in the insiders-outsiders explanation, it appears more difficult to find a direct link between wage drift and productivity.
[16] In our case "normal" hours refer to contractual hours as specified in union contracts. In practice this variable showed, in the period considered, little or no variation (see the Appendix).
[17] We also present OLS estimates for comparison purposes. Estimates do not differ substantially.

The model satisfies, at the conventional level of significance, most of the diagnostic tests performed (autocorrelation, structural and post-sample predictive stability[18]) and the fit is good. The assumption of normality in the residual was tested and rejected at the conventional level of significance. Since non-normality might be due to the presence of "technical inefficiency" in production, we shall pursue further the issue in the next section.

Parameter estimates are reported in table 1. The values of the coefficients have reasonable magnitudes, are correctly signed and in general statistically significant. In all formulations, the coefficient on the efficiency wage variable shows a positive and statistically significant effect on productivity; its value, in the "neutral" specification, implies an elasticity of output with respect to the efficiency wage variable of approximately 0.1. Similar results have been obtained for the "non-neutral" form. Notice that the "Solow condition", for the firm being at the profit-maximising level (as postulated in [6]), would have implied an elasticity equal to unity. However, it has been shown that, in some cases, the equilibrium effort-wage elasticity can be lower than unity, also the use of aggregate data might contribute to the result obtained here[19].

In addition to the basic model (columns (1) and (2), in table 1), other specifications were tried[20]. Coefficient estimates proved fairly robust to the inclusion of additional variables and to different functional forms[21].

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18 The test for structural stability is a Chow-test, the sample period was split at 1983:Q4. A full description of the tests implemented is contained in the Appendix.

19 Akerlof and Yellen (1986), provide several examples where the resulting equilibrium implies an effort-wage elasticity lower than unity. Furthermore, if efficiency considerations are likely to vary across firms within the same industry, aggregate elasticity could well be smaller than establishment-level elasticity.

20 Estimated returns to scale were around 1.2, though did not result statistically different from 1. This suggest the presence of constant return to scale in the industry considered. The inclusion of the labour capacity utilisation term showed a relatively small effect on output (ie. the coefficient is 0.03) suggesting a moderate utilisation of overtime as a mean of adjusting the labour input. A positive effect on productivity was captured by a time trend proxying for neutral technical progress.

21 A CES production function was also experimented, and the validity of Cobb-Douglas restrictions were tested. Although the restriction imposed were not rejected by the data, the overall performance of the equation was very poor.

Table 1. ***Estimates of Production Functions for the Metal-Mechanical Industry*** *(quarterly data: 1974:Q1 - 1985:Q4)*

	dependent variable: Value Added - ln(VA)				
RHS variab.	***(1) OLS*** *"neutral" form*	***(2) IV*** *"neutral" form*	***(3) IV*** *Coll. barg*	***(4) IV*** *"non-neutral" form*	***(5) IV*** *Unempl.*
*ln(K)**	0.597	0.599	0.582	0.589	0.601
	(4.27)	*(3.22)*	*(3.21)*	*(3.27)*	*(3.19)*
*ln(L)**	0.631	0.710	0.627	0.759	0.759
	(2.15)	*(1.95)*	*(1.38)*	*(2.05)*	*(1.95)*
(tn)	0.004	0.004	0.003	0.004	0.004
	(2.31)	*(1.90)*	*(1.20)*	*(1.98)*	*(1.83)*
(HL)	0.035	0.035	0.038	0.036	0.036
	(6.73)	*(6.05)*	*(6.26)*	*(6.27)*	*(6.21)*
$ln(W_i)$*	0.088	0.105	0.105		
	(2.52)	*(2.57)*	*(2.55)*		
$ln(W_c)$			-0.075		
			(0.56)		
$ln(L) \cdot W_{ind}$*				0.111	0.109
				(2.88)	*(2.66)*
ln(L)·Une					0.066
					(0.37)
Constant	3.479	2.535	6.240	1.728	1.897
	(1.32)	*(0.84)*	*(1.71)*	*(0.58)*	*(0.45)*
Diagnostic tests#					
-R^2	0.95	0.95	0.95	0.95	0.95
-SE	0.03	0.03	0.03	0.03	0.03
-Autocorrelation					
$\chi^2(1)$=3.8	2.44	2.90	2.85	2.94	2.94
$\chi^2(2)$=5.9	2.37	2.65	2.60	2.69	2.69
-Struct. stab.					
$F_{9,39}$=2.3	2.0†	2.2	2.3	2.0	2.1
$\chi^2(4)$=12	5.1	6.3	8.4	5.0	5.6
-Overid.Rest.					
$\chi^2(5)$=11	n.a.	5.2	5.2	5.0	5.3
-Normality					
$\chi^2(2)$=5.9	6.1	7.2	7.2	7.3	6.9
-RHS var.	8	8	9	8	9
-N.obs.	48	47	47	47	47

note: Absolute t-ratios in parentheses. A full description of the variables and their meaning is contained in the appendix.

* Denotes variables treated as endogenous

\# From (2) to (5) IV analogues of LM test

† The test has to be compared with $F_{9,40}$=2.2

Instruments included: $ln(L)_{t-1,t-2}$, $ln(K)_{t-1}$, $HL_{t,t-1}$, tn, $(W_{ind})_{t-1}$, $(W_{co})_t$, $(W_{min})_t$, $ln(VA)_{t-1}$ and seasonal dummies.

In order to test whether the efficiency variable was in fact capturing some spurious correlation due to "productivity bargaining", we introduced as additional explanatory variable the outcome of firm-level wage bargaining - ie. the collectively negotiated drift. The coefficient on the efficiency wage variable was almost unaffected, while the collectively bargained wage drift was negatively signed and not statistically significant. As advanced in the theoretical model, it seems that only the individual drift has a positive incentive effect on productivity, while increases in the bargained wage level play no significant role in boosting productivity.

In addition to efficiency premia, other variables were considered and their impact on productivity tested. As suggested by Shapiro and Stiglitz (1984), unemployment may act as a workers' discipline device. We could not, however, detect any significant effect of unemployment on productivity. Although the coefficient bears the correct sign, it is not statistically different from zero[22]. However, the general level of unemployment or its change might not be the appropriate variable to consider; unfortunately more disaggregated figures (ie. by duration, by sector, etc.) were not available for our purposes[23].

Finally, it may be worth inspecting further which of the two functional forms adopted, better fits the data. In other words we wish to discriminate between "neutral" and "non-neutral" specifications and evaluate how the efficiency wage variable enters the production function. On the basis of the tests implemented neither of the two specifications was rejected by the data[24]. This evidence, although inconclusive for

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22 Several specifications in addition to the one reported in table 1 were tried. However, neither alternative functional forms nor different expressions for the unemployed variable resulted significant.

23 The implications of "adaptation theory", according to which individuals tend to become accustomed to a certain state, have also been considered. In particular, as far as pay comparison standards (over time) are concerned, the issue that productivity might be influenced not only by the level of wages but also by their change was tested. No evidence was found in support of the hypothesis that workers quickly adjust their aspirations upwards. In the specification employed to test "adaptation" theory (not reported here), the lagged efficiency term appeared with the wrong sign and was not significantly different from zero.

24 The restrictions imposed (on a general functional form) and tested by means of an F-test were rejected by the data. We also tried a non-nested test (Davidson and MacKinnon, 1981) J-test, obtaining similar results.

our purposes, might suggest that the efficiency premium does not enter the production function in a unique well determined form[25].

3.1.1 *Efficiency vs. Inefficiency in the Production Function*

The discussion in the preceding section, concerning the formulation and the estimation of the production function, contains the implicit assumption that technical efficiency is always met for all firms in the sample and for each period considered[26]. Since firms are presumed to differ in their production activity and in their ability to achieve "efficiency" over time, the empirical specification should allow for deviations from the production frontier. Any such deviation is the result of factors under the firm's control (technical efficiency, employees' effort, managerial ability, etc.), as opposed to other sources of disturbance which are beyond the firm's influence (external shocks, etc.). Recently, a number of studies have formulated stochastic frontier production functions, in which a random shift in the frontier represents "technical inefficiency"[27]. The procedure proposed by Aigner, Lovell and Schmidt (1977) consists in a decomposition of the error term (as specified in [8]) in two parts:

$$\varepsilon = -u + v \qquad [10]$$

where v follows the usual normal distribution $N(0,\sigma^2)$ and u follows the truncated normal. The term $-u$ is the one-sided error which allows each observation to be on or below the production frontier. Conversely, the term v represent random shifts

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[25] It can be argued that technological, institutional and sociological factors do influence the form of the wage-effort function in different ways.

[26] "Technical efficiency" refers to the *maximum* amount of output obtainable from given input bundles and for a given technology. The output efficient locus is also defined as production frontier.

[27] For a survey on stochastic frontier estimation, see: Maddala (1983). Some applications are contained in the work of, Forsund *et al.* (1980).

in the frontier due to positive and negative external shocks[28]. Assuming u and v to be independently distributed, Aigner *et al.* show that,

$$f(\varepsilon)=(2/\sigma)\phi(\varepsilon/\sigma)[1-\Phi(\varepsilon\lambda/\sigma)] \qquad [11]$$

where $\sigma^2=\sigma_u^2+\sigma_v^2$, $\lambda=\sigma_u/\sigma_v$, and $\phi(\cdot)$ and $\Phi(\cdot)$ are, respectively, the density function and the distribution function of the standard normal. The particular parametrisation in [11] is convenient because λ can be interpreted as a measure of average inefficiency. In other words, $\lambda^2 \to 0$ implies, $\sigma_v^2 \to \infty$ and/or $\sigma_u^2 \to 0$ (ie. the symmetric error dominates in the determination of ε) and observations lie, in every period, on the frontier. Equation [8] was re-estimated specifying the error term as described in [10] and using a maximum-likelihood (ML) estimator. As far as the current specification is concerned, we shall only focus on the estimate of the measure of average inefficiency λ. In all the specifications considered the estimated value of λ was found to be equal to zero, suggesting that no serious inefficiencies - from period to period - are likely to affect the parameter estimates previously obtained. What conclusions can be drawn from the above results?

An attractive interpretation could be related to the presence of the EW variable in the production function. The payment of efficiency premia, it could be argued, by granting greater flexibility to firms reduces, in every period, the likelihood of significant deviations from the production frontier. However, it should be noted that the employment of aggregate data restricts the focus to efficiency over time, which leaves aside the more interesting issue of within-firm efficiency[29].

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[28] The two-sided error term v also captures measurement error in output.

[29] Also some care should be used in interpreting the results, since aggregate time series data may not allow for enough variation to estimate a stochastic frontier production function.

3.2 Wage Drift and Relative Wages

The results presented in the previous sections suggest some role for overpayments, unilaterally set by the firm, in enhancing aggregate productivity. However, what has been left unexplained, thus far, is how firms behave in setting pay premia. Several explanations concerning why firms might find it profitable to pay wage premia to their workers have been proposed in an earlier section, but nothing has been said as to how these premia are distributed across the employed pool. Also it appears interesting to be able to evaluate the relative importance of competing factors through which the wage drift-productivity relationship operates. In practice, this section attempts to investigate how firms choose overpayment policies to achieve higher productivity and efficiency gains.

Previous studies have analysed the role of wage drift on wage determination, using aggregate or industry data[30]. Holmlund and Skedinger (1988), use time series data for the Swedish wood industry, disaggregated by regions, and estimate different models considering the impact of contractual wage levels (centrally negotiated) on wage drift. In a similar study Holden (1989), using aggregate and industry data for Norway, estimates a wage equation in which the centrally negotiated wage increase is included among the regressors as additional explanatory variable[31]. Deutsch (1990) considers the impact of contractual wage increase on the growth of overpayments and on employment, using time series aggregate data for Austrian industry. In the latter paper, a further breakdown between skilled and unskilled labour is proposed, and a different role for overpayments between the two categories is found.

All the authors have come to the conclusion that centrally negotiated levels do have a relevant role in explaining aggregate wage determination. However, with the single exception of the work of Deutsch, no attempt has been made to evaluate the

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30 The works surveyed here mainly refer to wage drifts which originate from collective bargaining at the firm level, and no distinction is made between individual and collective drifts.

31 The dependent variable is defined as nominal wage increases in percentage.

impact of wage drift on relative wages (ie. by occupation, by firm, etc.). Moreover, none of the studies reviewed used highly disaggregated data.

As one might expect, a closer look at the distribution of wage drift across occupations reveals that the pattern of premia is not homogeneous. Indeed, as argued in one of the previous sections, the size of the drift differs substantially among individuals: with workers positioned up in the occupational ladder getting a higher premium. In other words, firms' wage drift policies have an impact not only on the aggregate wage level, but they also alter the pattern of relative wages. This behaviour is consistent both with the recent trend of progressive individualisation of pay levels, and with the different scope for employers to pay wage premia to recruit, motivate and retain workers. As the employment of aggregate data does not allow us to control appropriately for the existing differences, a micro-data set will be employed to analyse the determinants of wage premia.

The data set contains information on individuals employed in the same industry as the time-series study, namely the metal-mechanical industry. It also has a detailed decomposition of pay for each occupational category as indicated in union contracts[32]. The individual wage drift, as in the previous sections, is considered as that portion of the wage which is not the subject of explicit bargaining between the employer and the worker, but is unilaterally set by the employer.

From [7], we can define a structural wage equation where the drift is related to various terms which affect individual (effort) productivity. In a similar way to the studies reviewed above, we specify a functional form for the wage equation. In practice from [7], indicating with i the i-th individual and taking logarithms we obtain,

$$ln(w_i/c_i) = ln(e^{Z_i\gamma}) + ln(\varepsilon_i) \qquad [12]$$

[32] Data on actual wages refer to the 1985 ENI-IRI survey on pay (for the metal-mechanical industry), while information on pay composition was drawn from the 1985 Assolombarda survey on pay (see the appendix).

and rearranging,

$$ln(w_i/c_i)=\mathbf{Z}_i'\theta + v_i \qquad [13]$$

where the variables keep the same meaning as before, $v_i=ln(\varepsilon_i)$ is the error term, and θ is the vector of coefficients to be estimated. If equation [13] is specified with $ln(c_i)$ on the RHS, it is possible to test directly whether collectively bargained wage levels have an impact on the actual wage, and to discriminate between the "standard" EW model and the "drift-effect" model[33]. The former being the case in which the pattern of negotiated wages is completely offset by the drift mechanism and only the actual wage level is relevant; conversely, in the latter case, the individual drift is chosen with reference to the negotiated wage and the bargained level has a role to play. According to the results obtained the appropriate model will be estimated.

Given that the benefit for the employer paying wage premia lies in recruiting higher quality workers, reducing shirking, and retaining employees, variables included should proxy labour quality, monitoring conditions and turnover rates. Also, as the evidence presented in chapter 3 has shown, wage determination is likely to be influenced by firm's characteristics. The firm's "ability to pay", its size and financial structure, amongst others, proved to have a relevant role in shaping pay levels. The inclusion of firm's specific fixed effects (α_j) and of a firm size dummy, in [13] - given the lack, in the data set, of adequate information on firms' characteristics - provide a way of controlling for potential differences among firms[34].

In practice, the estimated equation contains several proxies for individual productivity/quality characteristics, namely: educational attainment, working experience, gender and occupational controls and various interaction terms. A variable measuring the extent of supervision deals with monitoring conditions, while

[33] For this purpose, a simple test on the parameter of the variable c_i being statistically different from zero will be considered.

[34] The vector of coefficients in [13] can be consistently estimated assuming that the number of individuals, in each firm, tends to infinity.

the length of job-tenure considers the turnover issue. Finally, a firm size dummy and fixed effects act as controls for firms' characteristics.

A number of *caveats* are in order before discussing the empirical results. First, when testing the relevance of the "standard" EW model *versus* the "drift-effect" version, it should be borne in mind that the contractual wage resulting from bargaining may be measured with error. Such measurement error, when the negotiated wage is included in the set of regressors, might produce biased estimates[35]. An appropriate IV estimator has been employed to deal with this problem[36]. Second, if the "drift-effect" model is the relevant one, some care should be used in the estimation procedure. In fact, serious problems arise in estimating equation [13] by ordinary least squares (OLS); since, as a consequence of the non-negativity of the dependent variable[37], parameter estimates are likely to be biased and inconsistent[38].

In order to discriminate between the two competing models, we estimated equation [13] without imposing any restriction on parameter estimates - ie. with the c_t variable on the RHS - and focussed on the implications of the collectively negotiated wage level. In other words, what is of interest here is to evaluate the impact of the c_t variable on the level of wages, this will be done performing a test on the sign and the significance of the parameter estimate (results are not reported). The coefficient detected on the c variable was positive and statistically significant confirming

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[35] Consider equation [13] specified with $ln(c_t)$ on the RHS, and let the observed bargained wage be defined as,

$$ln\, c_t = ln\, c_t^{*} + \gamma_t$$

where c_t is the observed variable, c_t^{*} is the true bargained wage level and γ_t is the measurement error. Equation [13] could be rewritten as shown,

$$ln\, w_i = Z_t'\theta + \delta(ln\, c_t^{*} - \gamma_t) + \nu_i$$

or rearranging,

$$ln\, w_i = Z_t'\theta + \delta(ln\, c_t) + \mu_t$$

where $\mu_t = (\nu_t - \delta\gamma_t)$. However the error term in the last equation is not independent of the explanatory variables and the OLS estimator of δ will be biased and inconsistent. A consistent estimate of δ can be obtained using an IV estimator.

[36] As instruments - assumed to be uncorrelated with the measurement error - we have used both the bargained component of the drift, which can be reasonably thought as highly correlated to the centrally bargained level but not to the individual drift set by the firm, and a relative wage term defined as the average wage of the firm relative to the average wage of the industry. The inclusion of only one instrument did not produce any significant difference in parameter estimates.

[37] This obviously depends on the nature of the wage drift and not upon the logarithmic transformation.

[38] Since, in equation [13], the variable measured with error appears on the left-hand-side, no problem should arise from the measurement error issue.

previous findings in the area, namely the importance of contractual wage levels in wage determination. In conclusion, collective wage agreements appear to set a wage floor which can be modified but *not* totally undone by discretional wage policies of firms.

On the basis of the above results, a "drift-effect" version of the model seem more likely to provide useful insights on the determinants and on the pattern of the wage drift. An appropriate specification of the model will be developed and estimated in the next section.

3.2.1 *The Determinants of Wage Drift*

The modelling of the "drift-effect" model is conditioned by the nature of the drift itself. In particular, if firms set optimal wage levels adjusting the individual drift relative to the wage level resulting from collective negotiation, the variable measuring the drift - as discussed in previous sections - is bounded (ie. non-negative) and OLS is not appropriate. In our case, the truncation problem takes the form of $(w_i/c_i) \geq 1$; that is, wages paid out are observed only when they are higher or equal to the bargained levels. A truncated regression model can be specified in order to obtain consistent estimates of the determinants of wage drift. As in [12], we can specify the wage drift as a function of a vector of explanatory variables.

$$y_i^* = \ln(w_i/c_i) = \mathbf{Z}_i'\theta + \varepsilon_i \qquad [12']$$

Let y_i^* denote the logarithm of the wage drift variable for the *i-th* individual. Thus we can write the model as follows:

$y_i = y_i^*$ *if* $\ln(w_i/c_i) > 0$

$y_i = 0$ *otherwise*

The density function of y_i is the truncated normal, where $Pr[y_i>0]=f[y_i \mid y_i>0]$ and 0 otherwise. The likelihood function for N independent observations is given by,

$$L = \prod_{y_i^*>0} \Phi(Z_i\theta/\sigma)^{-1}\sigma^{-1}\phi[(y_i - Z_i\theta)/\sigma] \qquad [14]$$

where symbols keep the same meaning as previously defined. Equation [14] was estimated by ML using Newton-Raphson methods[39]. Parameter estimates are reported in table 2. All equations include firms specific dummies[40].

To check the robustness of the results obtained some diagnostic tests have been performed on the estimated equations (results are reported in table 2)[41]. Particular care has been paid to the problem of heteroscedasticity in the residuals, since its presence in truncated regression models produces inconsistent estimates (Maddala and Nelson, 1975). However, the two heteroscedasticity tests implemented did not suggest any serious violation of the assumption of homoscedasticity[42]. In what follows parameter estimates of the preferred equations will be discussed and an interpretation of the main results will follow[43].

Labour quality variables appear to be positively correlated to wage drift. Although this result could be interpreted, in terms of a traditional human capital framework, as evidence of the working of market forces to counteract the effects of collective bargaining (a sort of re-equilibrating mechanism for wage differentials);

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39 The likelihood function is globally concave and therefore convergence to the global maximum is guaranteed. For a detailed discussion of truncated regression models, see Maddala (1983).

40 The joint significance of the fixed effects was tested by likelihood ratio (LR) test and the null hypothesis was rejected at the 5% level of significance, $\chi^2(40)=72.3$.

41 A description of the tests implemented is contained in the Appendix.

42 Diagnostic checks performed on wage-drift equations when firms' specific dummies were omitted (not reported here) showed the presence of some heteroscedasticity in the residuals. As this finding might be indicative of the nature of the heteroscedasticity, further tests were performed. The specific hypothesis that heteroscedasticity might be correlated to firms' specific characteristics was tested again after the inclusion of fixed effects in the original equation and no evidence was found (see table 2).

43 The collectively negotiated wage level (c_1) was also introduced as an additionally explanatory variable in the "drift-effect" version of the model, however since the parameter estimate was not statistically different from zero it was eventually dropped.

Table 2. ***Maximum Likelihood Estimates for Wage Drift Equations with Fixed Effects***
(Metal-Mechanical industry - 1985)

RHS variables	*dependent variable: wage drift- $\ln(w_i/c_i)$* (1) MLE	(2) MLE	(3) MLE
Labour quality			
Educ	0.0197	0.0189	0.0194
	(14.3)	*(13.2)*	*(13.1)*
Exper	0.0134	0.0121	0.0121
	(6.71)	*(5.87)*	*(5.89)*
$Exper^2$	-0.0001	-0.0001	-0.0001
	(3.56)	*(3.33)*	*(3.36)*
Sex	0.0189	0.0223	0.0235
	(1.61)	*(1.87)*	*(1.98)*
Blue-coll.	-0.0967	-0.0927	-0.0928
	(4.79)	*(4.57)*	*(4.58)*
Monitoring conditions			
Monitor.	-0.0782	-0.0775	-0.0817
	(11.9)	*(11.8)*	*(11.8)*
Monit size			0.0384
			(1.89)
Turnover			
Job-ten.		0.0018	0.0012
		(2.13)	*(2.17)*
Firm's characteristics			
Firm-size	0.0583	0.0569	0.1170
	(2.88)	*(2.81)*	*(1.87)*
Constant	-0.1678	-0.1570	-0.1634
	(4.76)	*(4.42)*	*(4.52)*
σ	0.1268	0.1267	0.1265
	(54.7)	*(54.7)*	*(54.7)*
Fixed effects included (40)	*yes*	*yes*	*yes*
Diagnostic tests			
-Log-Lik.	1684.8	1687.1	1689.9
-Heteroscedasticity			
$\chi^2_{(40)}=55.7$	37.8	37.0	37.1
$\chi^2_{(48)}=67.5$†	43.3 (48)	45.5 (49)	45.8 (50)
-RHS variables	48	49	50
-N. observ.	5,918	5,918	5,918

note: Absolute t-ratios in parentheses
† d.f. have been reported in parentheses at the side of the tests.

nevertheless, in the light of the general findings here obtained, we would like to propose a different interpretation. A competing explanation describes firms as optimally choosing the drift in order to recruit workers with higher education and labour experience.

The main difference between the two can be put in the following terms: while in the former explanation, departures from the negotiated wage levels are determined by market mechanisms and hence the firms' profit maximising behaviour leads to a "market clearing" equilibrium; in the latter case, wage drift premia are set unilaterally by firms and their optimal choices do not necessarily clear the market. Considering the recent Italian experience, any non market-clearing explanation seems more appealing.

In terms of gender characteristics a positive pecuniary advantage, of male as compared to (almost identical) female workers, emerges in the size of overpayments. This, in the light of the results obtained in the previous chapter, can be interpreted as further evidence that gender wage discrimination is reinforced by discretionary pay policies of firms. In other words, it might be argued that pay premia are also shaped by employers so as to satisfy their taste for discrimination.

Individuals employed in manual occupations receive - *ceteris paribus* - a smaller wage premium than non-manual workers. This evidence can be taken as a mild indication that individual overpayments are set by firms as to (partially) counteract the "egalitarian" effects of collective bargaining[44]. As advanced in section 2, overpayments tend to be larger for workers higher up in the occupational ladder. This may indicate that the greater is the degree of responsibility of the job the greater is the scope for the firm to motivate workers and promote effort and cooperation among individuals[45]. The negative relationship between wage drift and monitoring conditions can be interpreted in a similar way. According to the shirking version of

[44] Note, however, that this is different from any competitive explanation of wage differentials, as what matters here is the incentive effect played by overpayments.

[45] It may be argued that "insiders" effects are likely to produce similar results, as turnover costs are likely to be higher for non-manual workers. However, in terms of our framework, rent-sharing activity should affect the negotiated wage but not the individual drift.

the EW hypothesis, there is a trade-off between the extent of supervision and the level of wages. Strict supervision, as measured by the included dichotomous variable, is associated with smaller overpayment; or, that is the same, wage premia are being paid to workers endowed with self-controllable effort. This is an interesting result as neither the "competitive" model nor the "labour shortage" model would predict such a trade-off between monitoring activities and overpayments. Also, since monitoring activities are likely to be more difficult (and more costly) in big firms, a firm size control and an interaction term between monitoring and firm size have been considered. Although there is evidence that higher wage premia are being paid in larger sized firms, nevertheless this does not seem to be related with the existing conditions of monitoring[46].

Finally, the length of job-tenure shows a positive coefficient. Although some care should be used in interpreting this result, as some endogeneity between overpayments and tenure might be present; nevertheless, it seems that firms, in attempting to reduce turnover costs, are prepared to pay wage premia to their employees to retain them. In a perfectly competitive world there would be no reason for firms to reward long job tenure. Moreover, even if labour shortages were to be the main cause for the existence of overpayments, then the non-cooperative behaviour of firms in attracting high quality workers would rather imply a higher turnover and a lower tenure. The issue of the determinants of job tenure will be analysed with greater detail in the following chapter.

In conclusion it appears that the productivity and efficiency gains detected in the time series analysis come through wage drift premia which are shaped by firms so as to reduce shirking, to motivate workers endowed with self-controllable effort and to retain their best workers.

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[46] In order to check whether wage drift determination is significantly different between small and big firms, we fitted two separate equations and compared the results. With the only exceptions of the education variable, which showed a larger coefficient in the big-firm equation, all the others coefficients were not significantly different across the two equations.

4. Concluding Remarks

In this chapter the implications of a two-stage wage determination system have been considered, using time series and cross-section data for the Italian metal-mechanical sector. The analysis has focussed mainly on the second stage examining the impact of overpayments, set at the firm level, on productivity and on relative wages. A theoretical framework for the analysis of individual wage premia has been developed and different empirical specifications, suitable for estimation, have been derived. Both time series and cross-section analyses provided some evidence for the role of overpayments in enhancing productivity of employees, reducing shirking and promoting long term attachment to the firm.

Recent Italian experience seems to suggest that firms increased wages in an unilateral way paying efficiency premia, even when they were not pushed by unions to do so. In other words, firms used the drift mechanism granting wage premia to individual workers in order to motivate their active participation in the production process and also to retain them. Overpayments, it has been argued, are paid on top of the collectively negotiated level and have an impact not only on the aggregate level of wages but also on the pattern of relative wages by gender, occupation, and so on.

Central and local negotiation were shown to have a significant impact on wage determination. Bargained outcomes appear to be significantly modified but *not* undone by the discretionary policies of firms.

APPENDIX

(A) Data set and variables description

(i) Time series (section 3.1): Quarterly data from 1974:Q1 to 1985:Q4 for the metal-mechanical industry (aggregate).

Value added - ***VA*** Value added at 1970 prices.
(***source***: ISTAT, *National Accounts*.)

Services of capital - ***K=Ks·Cu***

(Ks) Gross Capital Stock at 1970 prices. Data are available yearly. They have been converted in quarterly series using real investment data.The decay parameter a was estimated with the usual technique:
$K_n = \sum(1-a)^{n-i} I_i + (1-a)^n K_0$ where K_n, K_0 are the end and the beginning of period capital stock, I_i is investment.
(***source***: G. Rosa e V. Siesto, *Il capitale fisso industriale*, Il Mulino; ISTAT, *National Accounts*.)

(Cu) Capacity utilization. Degree of utilization of machines.
(***source***: ISCO, "Congiuntura Economica".)

Normal hours worked - ***L=N Hn***

(N) Total employment
(***source***: ISTAT, *National Accounts*.)

(Hn) Normal hours as specified in labour contracts.
(***source***: Confindustria, *Rassegna di Statistiche del Lavoro*.)

Time trend - ***tn***

Labour Utilization - ***HL=Ot/Hn***

(Ot) Overtime hours, defined as the difference from actual hours worked and normal hours.
(***source***: Confindustria, *Rassegna di Statistiche del Lavoro*; ISTAT, *Supplemento al Bollettino Mensile*.)

Individual overpayments - $W_{ind}=OP_{ind}/W_{tot}$

(OP_{ind}) Individual overpayments unilaterally set by firms. Data are available twice a year, hence have been interpolated in order to be converted in quarterly series.

(W_{tot}) Total wages, deflated using the value added deflator for the metal-mechanical industry
(***source***: Federmeccanica and Assolombarda; ISTAT, *National Accounts*.)

Collectively bargained overpayments - $W_{col}=OP_{col}/W_{tot}$

(OP_{col}) Collectively bargained wage premia, from negotiations at the firm level.
(***source***: Federmeccanica and Assolombarda; ISTAT, *National Accounts*.)

Minimum contractual wage - ***Wmin*** Index of minimum contractual wages settled by central negotiation agreements.
(***source***: Confindustria, *Rassegna di Statistiche del Lavoro*; ISTAT, *Supplemento al Bollettino Mensile*.)

Rate of unemployment - ***Une*** Rate of unemployment adjusted for the CIG scheme.
(***source***: Confindustria, *Rassegna di Statistiche del Lavoro*; ISTAT, *Supplemento al Bollettino Mensile*.)

(ii) Cross-section data (section 3.2) for the metal-mechanical industry (individual level)

The data set employed has been obtained by merging information from two different data sets:

1) The earnings survey of ENI-IRI for the metal-mechanical industry (October 1985);

2) The real earnings survey of Assolombarda for the metal-mechanical industry (October 1985)

The first survey collects data at the individual level on gross annual wages, and contains detailed informations on personal characteristics, and on occupational and firm attributes. The total number of workers sampled (for the metal-mechanical industry) is approximately 6,000. All the workers are covered by collective bargaining.

The second survey contains detailed information on pay composition for each occupational category, as defined in union contracts, for the metal-mechanical industry (ie. 5 levels for manual workers, and 7 levels for non-manual). The survey covers approximately 500 firms in the same industry.

The total wage is disaggregated into the following components:

- contractual minimum (minimi contrattuali);
- indexation (contingenza);
- collective premia from firm level bargaining (superminimi collettivi);
- incentive premia unilaterally paid by the employer to individual workers (superminimi individuali);
- other contributions (meals, social activity, etc.);

Table A1 Description and Means of Variables

variable	*description*	*mean*
LWI	*ln(w/c) – wage drift*	*0.107*
Educ	*educational attainment (in years)*	*11.96*
Exper	*potential labour experience (age-educ-6)*	*21.55*
Sex	*gender dummy: (m=1; f=0)*	*0.82*
Blue-coll	*occupational dummy (manual=1; non-manual=0)*	*0.40*
Monitor	*monitoring conditions (strictly monitored=1; 0 otherwise)*	*0.70*
Job-ten	*tenure with current employer (in years)*	*14.3*
Size	*Firm size (N.employees) (1 if > 5,000; 0 otherwise)*	*0.12*
N. observations		*5,918*

(B) *Description of Diagnostic Tests Implemented*

-Autocorrelation

LM_1 - Lagrange Multiplier test for first order serial correlation, appropriate for IV estimation. The test is asymptotically distributed as a χ^2 with one degree of freedom (Godfrey, 1976; 1988).

LM_{1-4} - Lagrange Multiplier test for first and fourth order serial correlation (for quarterly data) appropriate for IV estimation. The test is asymptotically distributed as a χ^2 with two degrees of freedom (Godfrey, 1976; 1988).

-Heteroscedasticity

H_1 - Test for heteroscedasticity of the form,

$$Var(u_i)=\sigma_i^2=\sigma^2(\alpha+\beta Z_{ji})$$

where Z_{ji}, in our case represents firm specific dummies (40). The test is asymptotically distributed as a χ^2 with 40 degrees of freedom, and it is is carried out as $N \cdot R^2$ where N is the number of observations and the R^2 statistic is obtained from a regression of the squared residuals ($\hat{u}_i^2$) on a constant and the $\mathbf{Z}$ vector. The test, appropriately modified, is asymptotically valid for IV and Tobit models (Godfrey, 1988).

H_2 - Test for heteroscedasticity of a general form, as in Breusch and Pagan (1979). It is asymptotically distributed as a $\chi^2(p-1)$ where p is the number of estimated parameters. The test, appropriately modified, is asymptotically valid for IV and Tobit models (Godfrey, 1988).

-Omitted variables

OV_1 - Likelihood Ratio (LR) test for the omission of relevant variables with IV estimators,

$$LR=(S_1-S_1)/\sigma^2 - \chi^2(p)$$

where S_1, and S_1 can be replaced by the explained sum of squares from a regression of the residuals $\mathbf{u}_1$ and u_1 (restricted and unrestricted respectively) on the instrument set, and $\sigma^2=n^{-1}\hat{u}'\hat{u}$. It is asymptotically valid under H_0, and is distributed as $\chi^2(p)$ where p are the number of restrictions (in our case 40 for the firms' dummies). A modified version is also asymptotically valid for truncated models.

-Structural stability

ST1 - "Chow test" for constancy of regression parameters - slightly modified as one of the subsample (n_2) is smaller than the number of regressors (k) . It is distributed as $F(n_2,N-k)$.

ST2 - Sargan's postsample predictive stability test, it is calculated as $S=(\hat{w}'\hat{w})/\sigma^2$, where $\hat{w}$ is the vector of forecast errors over the period 1985:Q1-Q4 and it is distributed as χ^2 with four degrees of freedom (Godfrey, 1988).

-Overidentifying Restrictions

OR1 - Test of the overidentifying restrictions, is calculated as $N \cdot R^2$ where N is the number of observations and the R^2 statistic is obtained from a regression of the residuals on the instrument set $\mathbf{T}$. It is asymptotically distributed as a $\chi^2(g)$, where g are the overidentifying restrictions (Hausman, 1983).

-Normality

LM - An appropriate large sample test for departures from normality can be obtained as follows,

$$LM=N[(\sqrt{b_1})^2/6 + (b_2-3)^2/24]$$

where $\sqrt{b_1}=N^{-1}\sum u^3/\sigma^3$ (for skewness), $b_2=N^{-1}\sum u^4/\sigma^4$ (for kurtosis), N is sample size and other terms as defined before. It is asymptotically distributed as a χ^2 with two degrees of freedom (Kiefer and Salmon, 1983).

CHAPTER SEVEN

Job Tenure, Labour Mobility and Wage Profiles

1. Introduction

The features and the length of the attachment of workers to firms represent a central aspect of the labour relationship. The importance of the concept of "job tenure" - intended as period of time spent with the same firm - is well known both to employers and workers. The former use the information concerning individual lengths of service to plan human resources policies such as: selection and training, and the organisation of personnel. Alternatively, workers refer to seniority in order to program their career paths in terms of job security and promotions.

Furthermore, length of service - as emerged in previous chapters - is an important determinant of wages and of non-pecuniary benefits (*fringe benefits*), it affects internal mobility in the firm, and insulates workers with long job tenure from unemployment. From the firm's point of view, job tenure is effective in differentiating the "internal" from the "external" labour market, and in particular workers with specific human capital - difficult to be transferred and valuable to the firm -, from workers with general human capital - easily transferable-. In practice, a long job tenure with a firm seems to characterise a work relationship significantly different from temporary or short term employment relations; individuals with many years of

accrued tenure are considered (by employers) and behave differently from relatively new employees. Therefore, one further implication of the employer-worker attachment could be that traditional "spot" labour market characterisations become less capable of explaining the relevant features of the employment relationship. Conversely, when long term employment relationship are the rule, a "career" labour market representation - in which firms do not simply equate earnings to marginal productivity but also develop effective mechanisms to enhance the attachment of workers - could be more appropriate (Okun, 1981).

Finally, it is worth noting how the existence of the set of work rules (explicit or implicit), which link job tenure to various aspects of the work relation, is reinforced by the presence of a union. In order to ensure job stability and better work conditions for their members, unions have traditionally favoured the emergence of mechanisms which tie the well-being of employees to their seniority.

What is the role of job tenure? How is the long term attachment of employees rewarded? What are the effects on labour productivity? How does seniority affect individuals of different gender, age and educational attainment? These questions are central to any explanation of the functioning of labour markets, and hence to any theory which seek to explain wage and employment behaviour.

The purpose of this chapter is to investigate the pattern of worker attachment to firms in the context of Italian industry. The next section reviews various alternative theoretical models of labour mobility and job tenure. Section 3, presents some preliminary evidence on the pattern of attachment of workers to firms across occupations, gender and firm size. Section 4 then considers the nature of the data employed in the empirical section, and derives an econometric specification for the analysis of job tenure. The empirical results are presented and discussed in section 5. Some concluding remarks are contained in the last section.

2. Job Tenure and Labour Mobility

When considering the length of service with a firm, it is important to remember that the employment relationship is a bilateral agreement between the individual and the firm[1]. Therefore, job tenure has to be regarded as the result of a joint decision, where the worker, in each period, chooses whether to stay or go; and the firm whether to retain a worker or not[2]. In this context, the rationale which underlines the behaviour of economic agents (firms and workers) seem to suggests that, if the employment relationship lasts over time none of the parties, on the basis of the information available, can do better by breaking the agreement rather than respecting it (Parsons, 1986).

2.1 Job Search and Specific Human Capital

Since, our major concern is to explain why a worker remains in his job rather than going to work elsewhere, we discuss in this section the main implications of a simple model of job search while employed[3]. Define W as the present value of the current job (ie. including current remuneration and non-pecuniary components of pay); W^a as the present value of the alternative opportunities available to the individual, and let MP be the present value of the contribution given by the individual to the production process (marginal value product). Then the employment relation will continue up until the following inequalities hold,

$$MP \geq W \geq W^a$$

[1] The length of service is defined as the time spent with the same employer, independently of the different positions held.

[2] In the present discussion, it is implicitly assumed that the employment relationship represents a voluntary agreement for both sides. Hence, the existence of institutional constraints which might inhibit, or simply limit, the ability of each of the parties to interrupt at will the agreement is not considered here.

[3] Models of this type have been developed, amongst others, by: Burdett (1978), and Mortensen (1986, 1988).

In fact, if $W^a > W$, it will pay the worker to quit the present job and go and work elsewhere. Conversely, if $W > MP$ the firm, by keeping the worker, is accumulating losses and could do better firing him. In other words, for the employment relation to last - in the absence of significant adjustment costs - it is necessary that the wage paid to the employee is at least as big as available alternative opportunities, but not higher than the marginal value product to the firm.

The presence of firm-specific skills as a result of training, either prior to employment or on-the-job, can affect the relation between wage and turnover. In particular, while earnings potential associated with alternative opportunities can represent an incentive to mobility; conversely, the acquisition of firm-specific human capital (not transferable) may constitute a deterrent to mobility. Given that the financing of firm-specific investments will be borne, at least in part, by the firm, then it may be profitable for the employer to pay a wage premium, in excess to the alternative wage, in order to retain individuals endowed with specific skills (Becker, 1975; Oi, 1962)[4]. Therefore, the higher is the wage paid by the firm, the lower is the probability that the worker will voluntarily quit. From the above relationship the difference, ΔW, between MP and W^a can be decomposed as follow,

$$\Delta W = MP - W^a = (MP - W) + (W - W^a) = W(f) + W(w)$$

where $W(f)$ represents the returns to the firm of the investment in training for a particular worker, while $W(w)$ is the gap between the wage paid by the current employer and the alternative wage[5].

A more sophisticated approach has developed stochastic models of turnover in which the presence of uncertainty concerning either workers' productivities or firms

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[4] The case of training costs borne entirely by the worker it is unlikely to be of interest in the case of specific human capital. Becker (1975), shows that the financing of the investment will be optimally shared between the worker and the firm in order to minimise inefficient separations.

[5] In practice, it seems reasonable to expect that specific human capital will be accumulated by workers during the whole working life, rather than entirely at the beginning of it, and that pecuniary returns will grow accordingly at the same pace.

economic prospects (or both), generates a pattern of separations which depends on the moments of the distribution of the stochastic components (Hashimoto and Yu, 1980; Hashimoto, 1981).

The presence of specific human capital in simple search models, as discussed here, has interesting implications concerning the wage-turnover relationship. According to the model, different individuals will be characterised by different earnings profiles and by varying specific human capital endowments. For example young workers, whose specific human capital accumulation is lower and whose job search activity is more intense than for older workers, will exhibit a higher turnover. Clearly, this is true independently of the pure ageing effect[6]. Also, given the value to the firm of the specific skills accumulated with time, a higher tenure will - *ceteris paribus* - imply a higher wage. Finally, if the probability of staying in the current job increases with accrued seniority, job tenure *per se* might represent an important determinant of advancement within the occupational hierarchy of the firm.

In this framework, those individuals who possess specific human capital will, *ceteris paribus*, show a stronger attachment to the firm (*stayers*); conversely, employees with scarce accumulated specific capital will exhibit, comparatively, a higher (and persistent) turnover (*movers*). This characterisation of workers as *movers* or *stayers*, according to their mobility behaviour, implies a progressive divergence over time in the turnover rates of the two groups. In particular, for the *stayers* group, any increase in firm-specific skills (conditional on the wage) will increase the attachment to the firm and the time-dependence of accrued tenure (Jovanovic, 1979a; Mincer and Jovanovic, 1981). However, given that investments in job-specific skills and on-the-job learning processes mainly occur at the beginning of a job spell, it is

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[6] To see this, define the probability of separation (s) as a function of working experience (X) and accrued tenure (T),

$$s = (T,X)$$

the slope of the working experience schedule (ds/dX) is as follows:

$$ds/dX = [(\partial s/\partial T)(dT/dX)] + (\partial s/\partial X) \qquad \partial s/\partial T<0;\ dT/dX>0;\ \partial s/\partial X<0$$

where $\partial s/\partial T$ can be interpreted as the slope of the job-length schedule, dT/dX is the increase in job tenure due to the increase of working experience, and finally $\partial s/\partial X$ is the pure ageing effect. Therefore even ignoring the ageing effect ($\partial s/\partial X=0$), labour mobility is likely to decrease with working experience and the specific skills accumulated.

also possible that the time-dependence effects on tenure decrease over time. Hence, the final outcome concerning the time-dependence of tenure will depend on which of the two effects prevails. The assessment of these predictions is returned to in the empirical section.

2.2 Alternative Explanations

In the simple model of on the job search discussed above, the wage mechanism plays a central role in explaining workers mobility decisions. However, it appears rather simplistic to focus the attention only on relative wages. The probability of separation from a particular job is likely to be dependent on several other factors beside the wage rate. Some of these factors, relevant to both workers and firms, might concern: working conditions, stability of product demand and of employment, uncertainty about labour quality, existence of institutional constraints, layoffs by inverse seniority order and, not the least important, union behaviour.

In this section, we shall consider the implications of some alternative theoretical explanations, to the simple search framework, which incorporate some of the above characteristics.

Effort and Working Conditions

When a job contract is signed between the employer and the worker, both parties agree on a set of conditions which define the employment relationship. Generally, the agreement specifies the qualification required, the number of hours (daily, monthly) of work, the tasks to be performed and various other characteristics. It is, however, difficult to define precisely the intensity of work or the effort to be made. This aspect often requires the presence of a monitoring structure, so as to

ensure that working standards are accomplished. In all those cases in which minimum effort requirementsare not satisfied, the firm imposes a sanction -ie. the individual is fired. The extent of supervision depends both on the technological characteristics of the production process and on the incentive-punishment schemes adopted by the firm. The class of models based on efficiency wage consideration has given significant relevance to these factors in explaining long-term job relations. When turnover costs are relevant or shirking behaviour is particularly harmful to production, then the firm might be prepared to pay a wage premium to retain the worker or in order to guarantee that effort standards are always satisfied (Stiglitz, 1985; Shapiro and Stiglitz, 1984)[7]. These pay policies of firms tend to increase the opportunity cost of the individual in choosing the undesirable action (shirking or leaving), and have the effect of reducing both worker's and firm's induced separation. In a similar way, insider power models, also predict long-term employment relationship for "insider" workers. In other words, those workers who cannot be costlessly and quickly replaced - as a result of costly skills or seniority rights - will show longer job tenure (Lindbeck and Snower, 1986a).

Furthermore, when non-pecuniary aspects of the job (which affect the utility of the individual) are taken into account some of the predictions of the job search model, previously seen, are modified. In this case, it is possible for a worker to quit his current job, for a job with a lower wage, if the more favourable conditions of work are sufficient to outweigh the wage difference. On the contrary, a worker may occupy a low-wage job for a long period, if the non-pecuniary aspects significantly contribute to his well-being (Rosen, 1986).

Finally, it should be noted that remuneration schemes are often shaped to ensure long term employment. When the wage rate does not simply increase over time with worker's marginal product but also varies with the length of tenure, then the longer the worker stays with the firm the higher will be the loss associated with a

[7] Katz (1987), provides an excellent survey of the different models. For a detailed analysis of the various models see chapter 2.

voluntary separation. Firms might find it profitable to introduce increasing tenure-earning profiles, so as to discourage quits or enhance effort. In other words, a worker will be paid a wage below his marginal value product at the beginning of his working life within the firm, and, conversely, he will receive a wage higher than the value of his marginal product towards the end of his working life[8]. It is worth noting that, although the present value of this particular remuneration scheme is the same to the traditional spot equilibrium - in which the wage equals in each period the marginal value product -, nevertheless the former is more likely to produce long-term attachment between the worker and the firm, as benefits increase with accumulated seniority rights. Whilst in the context of the specific human capital approach a rising tenure-earning profile represented the optimal sharing scheme for the financing of the investment, in this case could be thought as an incentive mechanism to motivate or retain workers (Lazear, 1981).

Imperfect Information and Job Matching

An important aspect of mobility decisions, as opposed to long-term attachment, is related to the individual/job matching process. Workers heterogeneity with respect to their personal characteristics and to their preferences in terms of job attributes, is confronted in the labour market with the heterogeneity of available jobs in terms of professional requirements and working conditions. Therefore the job search process can be seen as a flow of workers who sample job vacancies taking into account: wage levels, working conditions, promotion prospects, etc; this search will come to an end when the matching of the characteristics demanded and offered is optimal. In the traditional model of search - with perfect information - both individual

[8] Mendes de Oliveira, *et al.* (1989), empirically test the pattern of wage profiles as implied by this hypothesis against that of the specific human capital approach. Their findings suggest that the tenure-earnings profile lies above the tenure-productivity profile during the period of intensive acquisition of firm-specific human capital. For a different interpretation see: Altonji and Shakotko (1987).

characteristics and job attributes are perfectly observed, respectively by the firm and by the individual. Hence, the sampling process - *ceteris paribus* - always guarantees an optimal individual/job match. However, job characteristics and working conditions are not immediately observable to the individual, and their knowledge might only occur after taking the job. In all those cases in which the individual/job match is not considered satisfactory, a quit will be observed (Pencavel, 1972). In a similar way, the employer might imperfectly observe workers' productivity or their job-mobility attitudes, and a correct assessment might only occur after a period of strict monitoring[9]. In the case of the job-matching model, the implicit assumption is that the current wage is equal to the expected value of the worker's marginal product in the job, *given current information*, and this relationship is updated with tenure and in response to new information. Specifically, the current job spell can end when information concerning a preferred wage alternative offer is available. Assuming that the probability of a better match (in terms of pecuniary and non-pecuniary attributes) increases - due to learning - with tenure on the current job, then the likelihood of a separation increases as time proceeds. On the contrary, in the specific-human-capital approach the increase in the likelihood of separation, with tenure, was explained by the higher expected future wage growth - due to more on-the-job training at the early stages of the spell - in the alternative job. Both the specific-human-capital and the job-matching hypotheses imply that the probability of separation *declines* with the current wage given accrued tenure, but *increases* with tenure conditional on the wage.

The implications which emerge from the above analysis are twofold: on the workers side, we are likely to observe both high mobility rates for workers who are actively seeking a "better" job (mainly, young workers, those with high propensity to mobility, marginal workers, etc.), and also an increasing probability of separation with tenure as learning about alternative job-matches improves. On the employer side, it is possible that firms will shape remuneration schemes so as to introduce a self-

[9] It is worth noting that in a world of perfect information, in which workers have perfect knowledge of the distribution of jobs/wages combinations (present and future), and in which firms could measure without error individual productivity; than, in a static equilibrium, no mobility would be observed.

selection mechanism among workers, creating good opportunities only for those they wish to retain (Salop and Salop, 1976). These class of models suggest that the length of job tenure will mainly depend positively on the "quality" of the individual/job match, and negatively on alternative job opportunities.

Several models of job matching have been developed in the literature, where uncertainty related to both individual and job characteristics is analysed in the context of a stochastic framework (Jovanovic, 1979a,b, 1984; Mortensen, 1988)[10].

Unions and Collective Voice

One of the aspects often neglected by job search type models is the influence of unions on attachment/separation decisions of workers[11]. In general, there is a large consensus among economists and industrial relations specialists in considering union members (or workers covered by collective agreements) as being more attached to the job and less prone to mobility (Freeman, 1980a,b). As far as the present work is concerned, it seem interesting to analyse which are the main routes through which unions can influence the length of job service.

In the traditional model, unions are described as monopolists in the labour market whose main objective is to increase wage levels for their members above the non-members levels. The resulting wage premium increases the well-being of union member and reduces their probability of separation. To the extent that wages in the union sector are significantly higher than in the competitive sector, then the former will be characterised, on average, by a longer job tenure (Abraham and Farber, 1987, 1988).

An alternative way, through which unions can influence the length of job tenure is the "collective voice" mechanism (Hirschman, 1970). When a divergence of

[10] Parsons (1986), provide an excellent survey of job matching models

[11] For a notable exception to this see, Stewart (1986). He analyses the impact of unions within a job search model.

interests, or a situation of conflict, arises between the individual (or a group) and the firm, a possible outcome is the interruption of the employment relation. The so-called "voice" mechanism provides a way to express disagreement, without having to quit the job. In this way, the exit-voice tradeoff is likely to reduce the turnover of organised workers by improving working conditions and by providing grievance/arbitration procedures to discontented workers (Freeman, 1980a,b; Freeman and Medoff, 1984).

Finally, union presence can influence employer-induced separation by imposing higher costs on the firm. There is a large evidence showing that firing costs are usually higher in the union sector, due to explicit rules protecting job rights. In particular, the introduction of LIFO (last in first out) criteria in redundancies decisions and in cases of temporary reduction of working hours, makes it extremely difficult and expensive to extend the effects to more senior workers[1]. In this respect the Italian experience related to the Cassa Integrazione Guadagni (CIG) is quite instructive (Treu, 1984)[2].

3. Implications of the Evidence: Some Preliminary Remarks

The patterns of turnover which regulate occupational flows in and out of employment seem to be very different across countries. Existing evidence has stressed the dynamic implications, of differing mobility rates, for the functioning of the labour market (Hall, 1982; Main, 1982; Parsons, 1986; Metcalf, 1989; Marsden, 1990). In the following sections, we first compare the average (elapsed) duration of

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[1] Note that in this way union behaviour is shifting the potential costs associated to the loss of job from the median worker to the more marginal worker.

[2] Most workers made redundant or laid off under the CIG scheme were mainly new entrants, trainees or individuals with short job tenure.

employment spells in Italy with the experience of other countries; and second, we analyse the main characteristics of job tenure in the manufacturing sector[14].

3.1 An International Comparison

The average duration of an employment spell in Japan is estimated to be between 15 and 20 years, while in the US similar figures suggests that it ranges between 5 and 10 years. At the end of his working life, the typical Japanese worker is likely to have changed job at least 5 times, and, of those changes, more than a half occurred before the age of 24. Alternatively, in the US labour market, the typical worker will have changed 4.4 jobs before the age of 24, and worked for 11 different employers before the age of retirement. As it appears, the differences between the two systems are striking and indicate a different attachment of workers to firms. In the Japanese labour market, the well known *nenko* system guarantees to most of the employed workers a job for the whole life; conversely, in the US high turnover rates, even for workers with long work experience, reduce substantially the length of job tenure (Hashimoto and Raisian, 1985)[15].

The experience of European countries is also instructive[16]. If we consider Germany and the UK, we are likely to find high mobility rates and relatively low attachment of workers to job; on the contrary, France and Italy exhibit an average length of job spells higher than the European average itself. An explanation often advanced to explain the observed differences, considers the different accumulation of specific human capital and the training systems which characterise the acquisition of skills in the respective labour markets. In particular, in Germany and in the UK the high degree of job standardisation contributed to develop an "occupational" labour

[14] For an analysis of job tenure in Italian manufacturing see, Faustini (1987).
[15] For a different interpretation see, Hall (1982).
[16] Empirical evidence, for different countries, on labour mobility and tenure patterns can be found in, OECD (1965, 1987)

market, in which the homogeneity of professional skills - constantly maintained by means of on-the-job training schemes - favoured the transfer of skills without high cost of adjustment. In France and Italy, the development of "internal" labour markets produced instead a strong attachment of workers to firms (Marsden, 1990). In this way, vacancies are mainly filled by promoting workers already employed in the firm, while access from the "external" labour market is limited to the lowest positions of the hierarchical structure.

3.2 Job Tenure in the Italian Manufacturing Industry

If the description of the working of labour markets, outlined in the previous section, is correct, then we should expect to find long term employment relations in Italian manufacturing industry[17].

In the sample considered, the average (elapsed) length of a job spell is 14 years, with a yearly mean probability of separation of 7 per cent[18]. Considering the working "life cycle" of individuals, from table 1, it is evident how the probability of separation diminishes with age. The above relationship besides describing the simple ageing process - for it is necessary to have a certain age in order to have long job tenure -, also suggests two more aspects of the employment relationship: first, it is possible that current tenure is dependent on past tenure - ie. the probability of separation is smaller the higher is accrued tenure; second, potential benefits

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[17] It is worth noting, however, that the hypothesis concerning the diffusion of "internal" labour markets in the Italian economy, is somehow altered if small firms (less than 20 employees) are considered. In particular, mainly for institutional reasons (labour legislation is significantly less restrictive for small firms), small firms show high rates of turnover. Therefore a sort of "dual" labour market is likely to emerge, with small firms showing high mobility rates and large firms showing strong attachment of workers to firms. However, as far as the present study is concerned, the analysis is limited to firms with more than 50 employees. An insight on the different pattern of mobility between small and large firms (in Lombardia) is contained in, Gay (1988).

[18] In the present section we refer to the length of a job spell without distinguishing between "completed" and "incomplete" spells. A detailed discussion of the differences and a rigourous treatment of the issue is presented in the next section.

associated with a separation decision decrease with age -ie. gains from job changes are likely to be smaller the closer the individual is to retirement age.

Table 1. - Length of Service and Probability of Separation by Age Groups

(disaggregated by sex)

Age Groups		*Length of Service*[1]	*Probability of Separation*[2]
up to 35 years	M.	6.79	14.7
	F.	8.68	11.5
from 35 to 50 years	M.	16.35	6.1
	F.	17.65	5.6
over 50 years	M.	23.62	4.2
	F.	25.70	3.8

note: 1 in years
2 in percentage, computed as the reciprocal of average length of service
M. refers to male workers
F. refers to female workers

Contrary to expectations, females show, within each age group, longer job spells[19]. In order to net out the influence of age (ie. the passing of time) from our measure of tenure, we calculated a "seniority coefficient" as a ratio between (elapsed) length of service and potential working experience[20]. The coefficient provides a rough estimation of the degree of attachment of individuals to firms. The range is between 0 and 1, respectively for perfect mobility or total immobility. Table 2 presents, for each age group, some bivariate correlations of the coefficient with educational attainments, wage levels and with an index of "job evaluation"[21]. Low correlations for the first age group (up to 35) suggest that a weak link exists between

[19] Some care is necessary in interpreting this result. In particular, as the sample refers to the manufacturing sector, it is possible that the mobility/separation behaviour of women is not very different from that of men. Furthermore, this result might show a stronger need for job security of female employment as opposed to men.

[20] Potential working experience is computed as a residual from the age of the individual and the age on completion of full-time education.

[21] The "job evaluation" index attributes to each occupation a given value which reflects: qualifications, responsibility, performance, work experience, etc.

tenure, wage and promotions[22]. This is consistent with a learning procedure, as in "job matching" explanations, where individuals in the first years of working experience move in search of an optimal match. Conversely, older age groups show a different picture: job tenure is linked to wage profiles and to the value attached to the job. In other words, good job matches guarantee an increasing wage profile and career advancement[23].

Table 2. - Bivariate Correlations by Age groups between Seniority Coefficient and Schooling, Earnings and "Job Evaluation" respectively

(disaggregated by sex)

Age Groups		*Seniority Coefficient*		
		Schooling	*Earnings*	*"Job Evaluation"*
up to 35 years	M.	0.21 (0.0001)	0.06 (0.0001)	0.14 (0.0001)
	F.	0.07 (0.0047)	0.02 (0.2745)	0.07 (0.0068)
from 35 to 50 years	M.	0.37 (0.0001)	0.28 (0.0001)	0.33 (0.0001)
	F.	0.36 (0.0001)	0.31 (0.0001)	0.30 (0.0001)
over 50 years	M.	0.42 (0.0001)	0.49 (0.0001)	0.47 (0.0001)
	F.	0.42 (0.0051)	0.23 (0.1380)	0.18 (0.2577)

note: in parentheses - Prob(H0: Rho=0)
M. refers to male workers
F. refers to female workers

In table 3, we report the mean values of selected variables disaggregated by educational attainments. On average, schooling (ie. general human capital) does not seem to affect the tenure behaviour of individuals. Probably a different picture would

[22] The choice of the age groups is completely arbitrary. However, experimentation with different age breaks produced similar results.

[23] It is interesting to note the low correlation for female workers in the oldest age group. While correlation with schooling is similar across genders, remunerations and occupational attainments are somehow different. A possible interpretation is that women do not benefit from long job tenure and from seniority rights in the same way as men. However, some care is necessary as the bias in potential experience measurement is also likely to be more important for older women.

have emerged if a years-of-training (ie. specific human capital) breakdown had been used instead. Unfortunately this information is not available in the present sample.

Finally, it is interesting to analyse the role of the organisational structure of the firm on job tenure and other variables. In particular, if firm size can be considered as a proxy for the existence of an "internal" labour market and for the presence of "union-voice" mechanisms, then a large size firm should be characterised by longer and more stable employment relations.

Table 3. - Earnings, Length of Service and "Job Evaluation" by Educational Attainments

(disaggregated by sex)

Educational Attainments		*Average Earnings*[1]	*Length of Service*[2]	*"Job evaluation"*[3]
Compulsory Education	M.	20059.8	14.2	220.4
	F.	17404.1	15.2	168.6
A-Levels	M.	24017.5	14.3	398.1
	F.	21756.7	14.0	254.1
Degree	M.	30200.3	14.8	639.5
	F.	28615.8	12.1	629.9

note: 1 - in thousand of lire
2 - in years
3 - range is between 112 and 852.
M. refers to male workers
F. refers to female workers

In table 4, job tenure, "seniority coefficient" and schooling are positively correlated with firm size (Barron, Black and Lowenstein, 1987). This is also consistent with the union-voice explanation (Freeman, 1980a)[24].

[24] In addition to the behavioural impacts of unionism implied by the union-voice theory, large size firms may accrue more job tenure also for selectivity reasons. If large size firms are innately more stable, then longer spells of job might exist irrespective of union presence. The lack of any information concerning union status of workers prevent us from any definite conclusion on the issue.

Table 4 - Average Length of Service, Seniority Coefficient, Working Experience and Schooling.

(disaggregated by firm size)

Firm Size[1]	*Length of Service*[2]	*Working Experience*[2]	*Seniority Coefficient*[3]	*Educational Attainm*[2]
up to 999 employees	11.93	21.58	0.552	11.98
from 1000 to 5000 employees	13.94	21.66	0.643	11.95
over 5000 employees	15.41	23.04	0.668	12.08

note: [1] - measured according to the number of employees
[2] - in years
[3] - ratio between length of service and working experience

3.3 The Occupational Structure of Job Tenure

The purpose of this section is to analyse the pattern of job tenure across occupations. In the previous sections, several explanations have been surveyed trying to identify the main factors which affect worker attachment/mobility decisions. Among these, firm specific skills, working conditions, wage levels and promotion prospects, appeared to be the most relevant. The data set employed in this study allows a highly disaggregated analysis of job tenure by occupations. Table 5 shows mean (elapsed) job duration, job evaluation and bivariate correlations between tenure and average pay levels for 89 different occupations[25]. Although, on the whole, different occupational levels show quite different characteristics, nevertheless some common pattern of behaviour can be identified. One feature which seem to have a significant role in determining the length of employment spells is the position occupied in the occupational hierarchy of the firm.

[25] The classification refers to the one adopted by the ENI-IRI survey.

Table 5 - Average Tenure by Occupations

Occupations	*Job[1] tenure*	*Job evaluation*	*correlations*
1. Group supervisor	14.99	418	0.38
2. Machine inspector	16.74	620	0.23
3. Shop-floor inspector	16.44	764	0.23
4. Mech. supervisor	17.11	394	0.19
5. General mech. superv.	19.78	803	0.06
6. 2nd mech. superv.	16.54	498	0.35
7. Area repair superv.	17.30	557	0.27
8. General repair superv.	17.53	689	0.24
9. Production programm.	14.28	348	0.23
10.Time/Method analyst	13.02	418	0.31
11.Techn. supervisor	17.70	620	0.04
12.Designers partic.	11.48	285	0.62
13.Project designer	15.16	394	0.45
14.Mechanical designer	17.30	498	0.43
15.Mechanical engineer	14.22	620	0.46
16.Warehouse operator	15.05	213	0.57
17.Warehouse supervisor	20.10	444	-0.01
18.Telephonist	13.34	181	0.49
19.Stenographer	9.97	167	0.51
20.Secretary	15.52	266	0.44
21.Laboratory techn. (B)	13.60	348	0.33
22.Laboratory techn. (A)	14.77	444	0.04
23.Laboratory supervisor	18.43	631	0.34
24.Buyer	13.89	348	0.43
25.1st Buyer	17.54	418	0.12
26.Buyer supervisor	18.99	557	0.10
27.Buyer general superv.	19.55	803	0.09
28.Files operator	14.04	197	0.43
29.Sales ass. (D)	12.55	305	0.15
30.Sales ass. (C)	10.87	394	0.01
31.Sales ass. (B)	14.07	470	-0.05
32.Sales ass. (A)	12.62	587	-0.01
33.Sales technician (B)	13.50	444	0.27
34.Sales technician (A)	13.19	620	-0.02
35.Researcher (C)	11.02	498	0.23
36.Researcher (B)	11.33	620	0.38
37.Researcher (A)	15.09	764	0.18
38.Punching operator	12.84	167	0.49
39.CED Operator	9.87	348	0.49
40.EDP Programmer	8.69	394	0.31
41.EDP Analyst	10.71	557	0.24
42.EDP System analyst	12.82	689	0.18
43.Head inspector	17.11	852	0.35
44.Payroll clerk	13.81	266	0.38
45.1st Payroll clerk	17.11	370	0.25
46.Payroll inspector	19.45	557	0.38
47.Accountant	14.27	305	0.40
48.Suppliers supervisor	18.83	557	0.12
49.Bookkeeper	14.30	213	0.51
50.1st Bookkeper	13.53	326	0.37
51.Auditing clerk	18.92	620	0.08
52.Accounting superv.	16.66	852	0.09

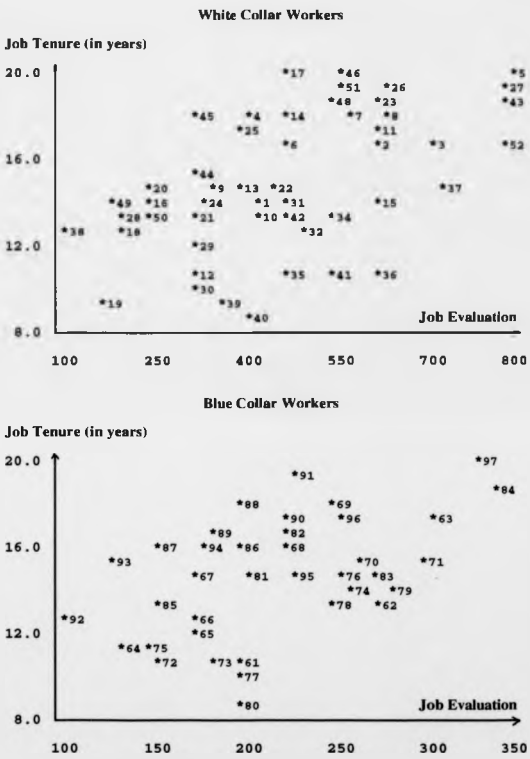
Table 5 (cont.) - Average Tenure by Occupations

Occupations	*job[1] tenure*	*job evaluation*	*correlations*
61. External operator	10.86	213	0.55
62. Machine operator	13.75	266	0.35
63. 1st Machine operator	17.58	305	0.40
64. Mechanical install.	11.87	138	0.42
65. Welder assistant	12.20	167	0.37
66. Stamping press oper.	12.04	167	0.01
67. Intern. transp. oper.	14.91	167	0.25
68. Stamping press insp.	16.00	230	0.19
69. Autom. machines insp.	17.42	247	0.42
70. Press repairer	15.29	266	0.35
71. Production mech. super	15.74	326	0.12
72. Assistant repairer	11.19	152	0.53
73. Mach. tools oper (B)	11.72	197	0.35
74. Mach. tools oper (A)	15.01	266	0.09
75. Electrician (B)	11.28	197	0.37
76. Electrician (A)	15.53	266	0.27
77. Specified mechanic (B)	11.31	197	0.61
78. Specified mechanic (A)	14.07	266	0.31
79. Electr. mech. repairer	14.34	266	0.10
80. Welder operator (C)	8.78	181	0.56
81. Welder operator (B)	14.30	213	0.21
82. Welder operator (A)	16.02	247	0.31
83. 1st Mech. repairer	14.52	266	0.26
84. Engineering technician	18.27	348	0.43
85. Distributor (B)	13.32	152	0.13
86. Distributor (A)	15.96	197	0.30
87. Auto driver	15.94	167	0.38
88. Lorry driver	18.12	197	0.28
89. Railway operator	16.49	197	0.51
90. Crane & tower oper.	16.78	230	0.25
91. Loading mach. oper.	19.40	230	0.28
92. Cleaning operator	12.30	112	0.38
93. Porter	15.43	138	0.37
94. Analyst B	15.49	197	0.36
95. Analyst A	14.16	230	0.35
96. 1st analyst	17.76	266	0.33
97. Analysts supervisor	19.68	326	0.12

note: [1] figures in years and fraction of year.

Figure 1 graphs the pattern of job tenure against the job evaluation variable for white and blue collar occupations, and reports the estimated correlations. A positive correlation is detected for both white (R=0.48) and blue collar (R=0.56) positions.

Figure 1. Job Tenure and Job Evaluation (White and Blue Collar Workers)



note: numbers correspond to occupations listed in table 5

This seems to confirm the hypothesis that vacancies, at higher levels of the occupational ladder, are mainly filled by promoting workers already employed in the firm - as in the "internal labour market" model -, rather than selecting them from the outside labour market - as in the "occupational labour market" model -.

A further aspect, which is worth analysing, is the relationship between job tenure and wage levels for narrowly defined occupations. Although, the positive relationship between wage and seniority has been widely reported in many empirical studies, nevertheless it is not still clear what exactly is remunerated and how it varies across occupations. When accrued job tenure is strictly related to increases in labour experience and individual productivity, then it should not be surprising to find increasing wage profiles; however, when this occurs between similar individuals doing identical jobs, it seems reasonable to look for an explanation. In almost every occupation considered, as shown in the last column of table 5, the correlation coefficient is positive and significantly different from zero. It might be argued that what the correlations are really picking up, is simply a relationship between remuneration and unobserved characteristics of individuals which grow with seniority. However, this is unlikely to be the case when considering narrowly defined occupations, in which individual characteristics are more or less homogeneous.

An alternative hypothesis suggests that seniority might be remunerated *per se*, in other words only as time proceeds. It has to be noted, however, that this hypothesis is less unrealistic than it might first appear. There are several reasons why a firm might find it profitable to pay - *ceteris paribus* - wage premia to more senior workers. For example, if "loyalty" to the firm is considered important, or if the recognition of a "senior" status to older workers favours morale and cooperation in the workforce, then the increase of wages with accrued tenure can have a major impact on firm productivity and profitability (Yellen, 1984; Akerlof, 1982; Akerlof and Yellen, 1986). These considerations can obviously be extended so as to consider the role of unions (Freeman, 1980a). In the "collective voice" mechanism seniority plays a central role, for signals sent to the management (pecuniary and non-pecuniary

grievances) are likely to reflect the preferences of the median worker, with greater seniority and a lower propensity to mobility.

4. Nature of the Data and Methodology of Analysis

The years of tenure accumulated by employees, as the evidence presented thus far has tried to illustrate, have important implications both for the functioning of labour markets and for the pay policies of firms. In the next section we analyse the characteristics of data on the duration of employment. Subsequently, we specify the empirical model to be estimated.

4.1 Nature of the Data

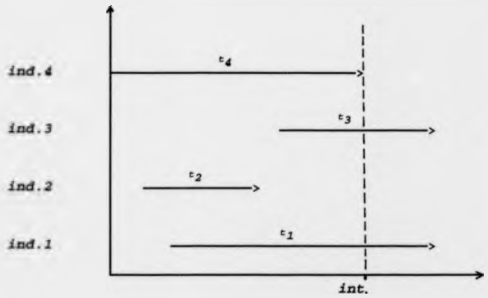
Typically, earnings surveys ask individuals the number of years and months of job tenure accumulated up to the moment of the interview. This means that what is actually measured are "incomplete" spells rather than the "complete" length of the employment relationship[26]. For example, assume that figure 2 describes the job tenure decisions of four different individuals. At the moment of the interview, indicated with *int*, only three of the four individuals will be observed (t_1, t_3, t_4), and two out the three observed have "incomplete" spells (t_1, t_3).

In general the mean of the distribution of "incomplete" spells will be different from the mean of the "completed" spell distribution. Two remarks are in order: first, when spells are not complete, it is reasonable to expect that tenure will increase as time proceeds; second, it is likely that longer spells (ie. as t_4 in figure 2)

[26] The nature of the data and the problems which arises in the analysis of the spells of employment are very similar to those faced by the vast literature on the duration of unemployment. See for example: Nickell (1979), and Lancaster and Nickell (1980).

have a higher probability to be observed, in a given sample, than shorter spells (ie. as t_2 in figure 2).

Figure 2 - "Complete" and "Incomplete" Employment Spells



In other words, on one side, the sample mean of incomplete spell will be smaller than the mean of completed spells; but, on the other side, the over-representation of longer spells will tend to raise the mean of incomplete spells. Clearly, only in a stationary world and with a constant separation propensity will the two effects cancel out, equalising the two means. In reality, as should be expected, when the probability of separation decreases as tenure goes up, the mean of incomplete employment spells will exceed that of completed spells.

In what follows, we shall develop a stochastic model for the analysis of incomplete spells. The probability of separation, in each period, is specified as a function of a set of individual characteristics and various other control variables. In particular, when estimating the determinants of job tenure it is important to control for a large variety of economic variables which are likely to influence the length of

employment spells. As discussed in section 2, educational attainments, investment in specific human capital, propensity to mobility, working conditions, union presence, turnover costs and alternative wage opportunities, among others, are likely to have an impact on the attachment/separation decisions of workers. As far as the present study is concerned, particular care will be devoted both to the nature of the data and to the determinants of tenure. However, data deficiencies and the complexity of the problem to be investigated set the limits of our analysis. The next section describes the empirical model.

4.2 The empirical model[27]

This section discusses the main implications for the analysis of duration data, and derives a likelihood function suitable for estimation. The simplest way to characterise the concept of job tenure, from the perspective of probability theory, is to consider the length of a job, T, as a "waiting time" variable whose duration depends on the probability P, that the employment relationship ends in a given period, and the probability $1\text{-}P$ that, in the same period, it continues. In this case, it can be assumed that each individual, in a given period, faces a constant probability of separation; that is, conditional on being employed through last week, the probability of leaving the job this week is P.

However, the assumption that the probability of separation is constant does not look very appealing. Indeed, as described in the previous section, one might expect the conditional probability of holding a job to vary with the length of the job. If P is dependent on cumulated job service, then the previous assumptions are no longer appropriate and a different model is needed.

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[27] The empirical model developed in this section is a simplified version of Stewart (1986). I am grateful to Mark Stewart for having made available to me the results of his work in progress.

In what follows we shall develop a continuous time model. Consider the non-negative random variable T to be the duration of time spent in the job. The probability distribution of duration can be specified by the cumulative distribution function $F(t;x)$, where x is a set of variables and t is the time spent in the job. The corresponding density function is $f(t;x)=dF(t;x)/dt$. We may define a survivor function as,

$$S(t;x) = 1-F(t;x) = P(T \geq t;x) \qquad [1]$$

which is the probability that the random variable T will equal or exceed the value t. Call $h(t;x)dt$ in $(t,t+dt)$ the conditional probability of separation (known as the hazard function in the biomedical literature), which is a function of a set of variables x, and the length of time an individual has already spent in the job. The hazard function $h(t,x)$ can be written as,

$$h(t;x) = f(t;x)/(1-F(t;x)) \qquad [2]$$

A useful way of specifying the hazard function is to consider two different components, of which the first is a functional form for the dependence on time and the second is a description of how the hazard h shifts, at given points in time, across different types of individuals. This form is known as the proportional hazard form (Cox, 1972). In particular the proportional hazard Weibull specification, which has been widely used in studies for the analysis of unemployment durations (Lancaster, 1979; Nickell, 1979), will serve as the basis for our estimation. The function can be specified as follows,

$$h(t;x) = \lambda t^{\lambda-1} exp(x'\beta) \qquad [3]$$

where the hazard rises or falls monotonically as $\lambda>1$ or $\lambda<1$. The case of $\lambda=1$ correspond to the exponential distribution, where the length of time spent in the job is independent of time.

Since our length-of-job variable refers to the stock of workers currently employed, we need to derive the density function of incomplete spell durations (accrued tenure). Nickell (1979), and Lancaster and Nickell (1979) discuss the problem in detail, so, in what follows, we shall mainly refer to their work[28].

Assume that the rate at which individuals join the stock of employed is fixed over time at $e(x)$. Then the probability of an individual being employed at time t is given by,

$$E(t) = \int_0^{\infty} e(x)\, F^{i}(v;x)\, dv \qquad [4]$$

where $F^{i}(v;x)$ is the inflow survivor function for an individual with characteristic x. The probability of having entered employment in the past, conditional on being employed at time t, can be written as,

$$P\{T>t;x\} = \frac{\int_0^{\infty} e(x)\, F^{i}(t+v;x)\, dv}{E(t)} = \frac{\int_0^{\infty} F^{i}(t+v;x)\, dv}{m(x)} \qquad [5]$$

which is the survivor function for elapsed duration, and where $m(x)$ is the mean completed duration for a given x. The corresponding density function for elapsed duration, as seen before, can be obtained as follows,

$$f(t;x) = \frac{dP\{T>t;x\}}{dt} = \frac{F^{i}(t;x)}{m(x)} \qquad [6]$$

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[28] See also: Cox and Oakes (1984), and Kalbfleish and Prentice (1980).

The likelihood function can be written in the following way,

$$L = \prod \frac{F'(t;x)}{m(x)} \qquad [7]$$

and estimated by maximum likelihood techniques.

In term of the Weibull specification adopted in [3], the survivor function is the following,

$$F'(t;x) = exp[-\int_0^t h(v;x)dv = exp[-t^{\tau} exp(x'\beta)] \qquad [8]$$

setting $\tau = 1/\lambda$ and $k = exp(x'\beta)$ we can rewrite it as,

$$F'(t;x) = exp[-kt^{1/\tau}] \qquad [9]$$

The mean completed duration, for a given x, is,

$$m(x) = \int_0^{\infty} F'(t;x)dt = \int_0^{\infty} exp[-kt^{1/\tau}]dt = \Gamma(1+\tau)\,k^{-\tau} \qquad [10]$$

Substituting [9] and [10] into [6], we obtain an explicit specification for the density of elapsed duration,

$$f(t;x) = \frac{k^{\tau} exp[-kt^{1/\tau}]}{\Gamma(1+\tau)} \qquad [11]$$

From [7] taking logarithms we can derive the log-likelihood function,

$$ln\, L = \sum \{\tau ln k - kt^{1/\tau} - ln\Gamma(1+\tau)\} \qquad [12]$$

The above likelihood function was estimated using the "minimise" routine in the LIMDEP package. In practice, the Davidson, Fletcher and Powell (DFP) algorithm was chosen[29].

5. Results

This section presents Maximum-Likelihood estimates of the econometric model developed in the previous section. The sample used refers to male workers employed in the manufacturing sector. The exclusion of female workers is explained by the unreliability of the measured length of employment spells for married women, in the light of their interrupted participation in the labour market. However, before discussing the empirical results obtained, some *caveats* concerning both the methodology employed and the choice of variables are in order.

As section 2 made it clear, mobility decisions of workers are closely related to the wage earned in the current job and on alternative wage opportunities. In other words, this means that the *current* wage, when modelling job tenure, should be treated as endogenous. We can posit the relationship in the following way,

$$T=T(\boldsymbol{X},w) \qquad [13]$$

$$w=w(\boldsymbol{X},T) \qquad [14]$$

where T indicates elapsed job tenure, $\boldsymbol{X}$ is a set of economic variables and w is the *current* wage.

Therefore, any attempt to include the *current* wage among the regressors ignoring the underlying simultaneity problem will produce biased estimates. In this study no attempts have been made to model the simultaneous tenure/wage decisions

[29] The DFP routine requires no derivatives and provides a numerical estimate of the Hessian.

of workers, as outlined by [13] and [14]; hence, in interpreting the results the wage should be considered, in any period, as given. However, in order to capture the effect of *alternative* wage opportunities, the average industry wage - in which the individual is employed - has been included. Under fairly reasonable assumptions this can be considered exogenous. Other variables included are age at completed full-time education, age on entry to the job, two working conditions controls and a firm size dummy[30]. The dependent variable records the length of job tenure for each individual measured in elapsed months. In one specification, we also included several dummies to account for industry-specific characteristics that might affect the turnover rate.

Finally, in order to account for the different mobility behaviour and for the different type of accumulated human capital, separate hazard functions for white and blue collar workers have been estimated. This, also allows us, rather crudely, to control - given the lack of any other indicator - for the effect of unionism on tenure[31]. Estimated parameters, as reported in tables 6 and 7, can be interpreted as the proportional impact on the separation probability.

The age of completed full-time education variable shows a positive impact for both blue and white collar, although, as one would expect, the effect is bigger for the latter group. Therefore, as suggested by the human capital approach, investment in generally transferable skills increases the probability of separation. Age on entry to the job shows a negative impact, suggesting that - *ceteris paribus* - a higher working experience, previous to the current job, increases the probability of staying on in the firm. This is consistent both with the hypothesis that the learning process leads to better individual/job matches, and with the fact that late joiners will have a shorter span of time for the benefits associated with a job-change.

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[30] Note that the age on entry variable is the appropriate control to be considered. Define A_T the individual's age at T, where T is the elapsed duration of the job. Also, it is possible to write, $A_T = A_0 + T$, for all T. Hence, the exogenous variable which should enter the hazard function is A_0 age on entry to the job (see Stewart, 1986).

[31] Under the assumption that blue collar workers are both more likely to be unionised, and more prone to use the "voice" mechanism, it is reasonable to expect - *ceteris paribus* - a different behaviour.

Working condition dummies seem to suggest that unpleasant job attributes have a negative impact on the separation probability. This evidence contrasts with the argument that, conditional on the wage paid, favourable working conditions favour long term attachment of workers. Although, this result might be rationalised in terms of low-skilled individuals in bad jobs with no better prospects of employment; nevertheless, its implications are unclear. The effect of firm size is negative. This confirms our earlier result that large and stable organisation are more likely to experience long term employment spells. Also, as already discussed, the "voice" mechanism of unions might be more effective in large firms.

Table 6. - Maximum-Likelihood Estimates of the Hazard Function for Blue-Collar Workers

(dependent variable log of length of tenure)

	(1)	*(2)*	*(3)*	*(4)*
λ	1.915	1.972	1.984	1.993
	(0.0203)	*(0.0202)*	*(0.0202)*	*(0.0202)*
Agescl	0.016	0.013	0.011	0.013
	(0.0036)	*(0.0038)*	*(0.0038)*	*(0.0037)*
Agejob	-0.068	-0.070	-0.071	-0.071
	(0.0013)	*(0.0012)*	*(0.0012)*	*(0.0012)*
Work/cond		-0.563	-0.541	-0.549
		(0.0225)	*(0.0225)*	*(0.0224)*
Monitor		-0.259	-0.271	-0.287
		(0.0183)	*(0.0183)*	*(0.0182)*
Firm Size		-0.272	-0.311	-0.338
		(0.0190)	*(0.0195)*	*(0.0196)*
ln(alt/wage)			2.163	
			(0.1718)	
Constant	-3.547	-3.698	-1.302	-3.789
	(0.0808)	*(0.0871)*	*(0.7938)*	*(0.0852)*
Other control variables				
Industry controls	*no*	*no*	*no*	*yes*
Log-Likelihood	-5008.2	-4825.8	-4804.1	-4784.5
n. of observations	5197	5197	5197	5197

note: Asymptotic standard errors in parentheses. A full description of the variables and their meaning is contained in the appendix.

Table 7. - Maximum-Likelihood Estimates of the Hazard Function for White-Collar Workers

(dependent variable log of length of tenure)

	(1)	*(2)*	*(3)*	*(4)*
λ	2.129	2.164	2.169	2.171
	(0.0287)	*(0.0284)*	*(0.0285)*	*(0.0282)*
Agescl	0.021	0.025	0.018	0.015
	(0.0094)	*(0.0093)*	*(0.0093)*	*(0.0095)*
Agejob	-0.050	-0.049	-0.048	-0.049
	(0.0012)	*(0.0011)*	*(0.0011)*	*(0.0011)*
Work/cond		-0.138	-0.119	-0.110
		(0.0171)	*(0.0173)*	*(0.0176)*
Monitor		-0.280	-0.273	-0.286
		(0.0302)	*(0.0306)*	*(0.0379)*
Firm Size		-0.452	-0.465	-0.481
		(0.0184)	*(0.0190)*	*(0.0191)*
ln(altwage)			1.081	
			(0.1707)	
Constant	-3.227	-3.400	-1.102	-3.473
	(0.1524)	*(0.1553)*	*(0.7927)*	*(0.1618)*
Other control variables				
Industry controls	*no*	*no*	*no*	*yes*
Log-Likelihood	-3467.7	-3384.2	-3379.3	-3376.1
n. of observations	4076	4076	4076	4076

note: see table 6.

A strong positive effect of the alternative wage on the separation probability was detected, both for white and blue collar workers. As predicted by almost all the theoretical explanations surveyed in section 2, outside opportunities play a relevant role in the separation/attachment decisions of individuals. The effect of the alternative wage on the separation probability, with respect to the reference category, is bigger for blue collar than for white collar workers. Included industry controls were jointly significant, suggesting that differences in separation propensities exist among industries[32]. However, the remaining coefficient estimates were largely unaffected by the inclusion of the industry controls.

[32] The null hypothesis of all the industry dummies being jointly zero, was tested by means of a likelihood ratio test for both white and blue collar hazard functions. The test is distributed as a χ^2 with

Finally, we shall discuss the implications of the estimate of λ, which can be interpreted as evidence of duration dependence. In all the specifications of the hazard function we estimated, the value of λ was found to be significantly greater than 1. As discussed in section 4.2, this implies that the hazard is monotonically increasing and, therefore, that the probability of separation increases with tenure[33]. In other words, this means that, *conditional on the wage*, the probability of leaving the job increases with the length of the job spell. Although the reasons advanced are different, this is what both the specific human capital approach and the job matching hypothesis, suggest. Also note that this is not inconsistent with the evidence presented in section 3, where observed separation rates were found to be declining with tenure, as that finding refers to the unconditional rate. In term of the present estimates a similar result could be obtained if, after modelling simultaneously the wage/separation decision, the wage effect would more than compensate the conditional effect. Unfortunately, the simplification introduced in the specification of the model estimated here - ie. neglecting the role of the *current* wage - does not allow any inference on possible unconditional outcomes.

Clearly, both the distributional assumption (ie. Weibull) made to derive the hazard function estimated, and the possibility that "omitted" (unobserved) variables may lead to biases in the estimates, set further limits to the present analysis. As far as the first point is concerned a more general baseline hazard function would have been desirable in order to leave more flexibility in the estimation procedure, this however would have complicated further the specification and the estimation of the model and the gains in generality would have been offset by the loss of simplicity. The second point is related to the problem of unobserved heterogeneity. In particular, individuals may differ in certain unmeasured characteristics that influence the probability of experiencing long spells but are not influenced by the length of the employment spell.

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6 degrees of freedom (critical value at 0.05 significance level is $\chi^2(6)=12.59$), results of the tests are reported below.

$L_w=16.2$; $L_{bc}=82.6$

[33] The monotonicity of the hazard is guaranteed by the use of a Weibull distribution.

If these unmeasured characteristics are correlated over time, and are not adequately controlled for, past employment may appear to be a determinant of current and future employment simply because it is proxying for temporally correlated unobservables (Lancaster, 1979; Heckman and Singer, 1984, 1986). In general, the omission of relevant unmeasured characteristics may produce evidence for the existence of a conditional relationship between future and past employment only due to uncontrolled heterogeneity. However it should be noted that, as far as the latter argument runs, the downward bias which may arise in the duration dependence parameter as a consequence of neglected heterogeneity should not change our main conclusions, but rather reinforce them.

6. Concluding Remarks

This chapter has analysed the patterns of worker attachment to firms. Several explanations for the existence of long-term employment relationships have been considered and the theoretical implications discussed. It has been argued that the existence of both specific human capital and of transaction costs tend to discourage workers mobility favouring the development of "internal" labour markets. These factors put into question the traditional "spot" labour market characterisation as a valid representation of the working of labour markets. The empirical evidence presented for Italian manufacturing industry provide support to the view that the Italian labour market is characterised by long-term employment relationships and that job mobility occurs mainly within the firm rather than between firms. Furthermore there is evidence that unions, particularly in Italy, in order to ensure job stability and better work conditions for their members favour the emergence of mechanisms which tie the well-being of employees to their seniority.

The nature of the data on duration of employment required particular care in the empirical analysis. First, the presence of "incomplete" job spells suggests that the mean length of the employment relationship will increase as time proceeds and generally will be different from "completed" spells; second, it is likely that longer spells have a higher probability of being observed, in a given sample, than shorter spells.

An appropriate methodology for the analysis of "incomplete" spells has been developed and a stochastic model estimated. The sample used refers to male workers employed in the Italian manufacturing sector, and two separate equations for white and blue collar workers have been estimated. Results suggest that, given the wage, general human capital increases the probability of separation from the current job, while previous work experience reduces it. The effect of firm size, *ceteris paribus*, is to reduce the probability of separation, as large and stable organisations are more likely to experience long term employment spells. The estimates of the duration dependence parameter indicate that the probability of leaving the job increases with the length of the job spell. As shown, this result is also consistent with the observed declining rate of separation with tenure, since the latter refers to the unconditional rate.

Finally, a number of methodological *caveats* have been discussed. Although, the presence of potential neglected heterogeneity might produce biased results, nevertheless, it has been shown that the direction of the bias should not change our main conclusions but rather reinforce them.

APPENDIX

Table A1. - Definitions of Variables and Mean Values (White and Blue Collar Workers Samples)

Variables		*Means*	
		White coll	*Blue coll*
ln(tenure)	logarithm of elapsed job tenure (months)	2.46	2.51
Agescl	age of completed full-time education	19.9	15.5
Agejob	age on entry to the job	25.9	27.1
Working Conditions	1 if unpleasant 0 elsewhere	0.13	0.40
Monitoring	1 if strict monitoring 0 elsewhere	0.54	0.87
Firm Size	1 if over 5,000 employees 0 elsewhere	0.12	0.16
ln(alt-wage)	average industry wage	5.1	4.6
N. observations		4,076	5,197

CHAPTER EIGHT

Summary and Conclusions

As discussed at some length in the introduction of this thesis the issue of wage dispersion and the evaluation of adequate explanations of wage determination mechanisms in the context of the Italian economy is a central theme for a better understanding of the functioning of the labour market. The complexity of the phenomenon suggests that any simple characterisation of the underlying factors would tend to misrepresent the real world. As relevant U.S. and U.K. studies - surveyed in this thesis - have shown, the inter-relationship between union behaviour, product market characteristics, institutional attributes and market mechanisms are crucial factors in any explanation of wage setting procedures. This thesis has used econometric techniques both to ascertain the impact of some of the above listed factors on wage determination and to assess the validity of competing models of pay setting as adequate explanations of the functioning of the Italian labour market.

If a general conclusion can be drawn from the results which emerged from the work undertaken in this study, it is that traditional competitive theories of wage determination represent an insufficient tool of analysis for the explanation of wage formation mechanisms.

Chapters 3 and 4 provided complementary evidence using various data sources to show that industry and occupational affiliation, *ceteris paribus*, plays a relevant role in shaping pay levels. Inter-industry wage differences but also inter-firm

wage dispersion within any given industry is explained, among others, by firms' product market power and by their financial performance. The existence of a positive relationship between pay levels and profitability suggest that firms' "ability-to-pay" is an important determinant of wages. Moreover, rent-sharing mechanisms appeared to be more marked where there exists a greater ability to earn monopoly profits.

Chapter 5 investigated the issue of gender wage discrimination. A common finding of empirical studies, for different countries, is that women are paid less than comparable male workers. Empirical evidence for Italy showed that although male/female pay differences, in the manufacturing industry, are not large in magnitude, nevertheless women tend to be segregated in low pay jobs with poor job advancement prospects.

The finding that significant wage dispersion exists also among firms operating in the same sector, stimulated further investigation as to which are the main determinants of firms pay policies. In chapter 6, the two-stage wage determination system operating in Italy has been analysed using both time series and cross section data for the metal mechanical industry. Firms appear to pay wage premia on top of collectively negotiated wage levels in order to enhance productivity, reduce shirking and incentivate workers' attachment to the firm. The second-stage wage-setting process was shown to have a significant impact on pay levels, however it did not offset completely the pattern of bargained wage levels.

Chapter 7 analysed the features and the length of employer-employee attachment. The role played by the wage under long-term attachment appeared to extend beyond providing signals for labour reallocations; indeed, skill acquisition, lower turnover, and loyalty to the firm proved to be factors which affect wage determination in various ways. The main finding has been that the traditional "spot" labour market characterisation cannot be easily reconciled with the existence of long term relationships as observed in the Italian labour market. Work experience and firm size, *ceteris paribus*, appeared to favour longer job tenure, while educational attainments and outside opportunities reduced it.

Hence the composite picture that emerge from these studies seems to raise some doubts as to the adequacy of competitive theory for the explanation of various labour market phenomena. Several factors, often neglected by traditional economic theory, have proved relevant to explain wage formation mechanisms in the context of the Italian manufacturing industry. Alternative theories of wage determination, which stress the importance of non-competitive aspects, appear to provide a better framework of analysis. A common feature of the various models analysed is that wage formation can be seen as a sharing mechanism where bargaining practices, insider power or efficiency wage considerations, or a combination of all of these, are important factors in shaping pay levels. Although one would like to discriminate among these competing models, nevertheless the task is not easy as their relevance is often not independent one from the other. As chapter 6 has tried to show bargaining practices, efficiency wage considerations and insider power interact in various ways and at different stages of pay setting, therefore it would be rather restrictive to favour one explanation at the expense of the others. Under stronger assumptions more clear cut predictions could be obtained, however this will be at the expense of the general approach which has been adopted in the thesis. The main purpose has been throughout the whole work that of providing a better understanding of wage determination mechanisms in the Italian labour market.

It should be noted that as the most of this work is based on cross section data, the evidence found is conditional on a static analysis. The analysis of more dynamic issues such as the evolution of the wage structure has only been marginally considered. Indeed, this is a major drawback which is entirely explained by the unavailability of panel data for Italy. As it has been discussed at some length in various sections of the present thesis, data limitations seriously constrain the kind of economic issues which one would like to address when looking at wage determination evidence. However given the almost complete lack of comparable studies for Italy on these issues, this should be considered simply as a first step which need to be

supported by further studies on different data sets. Certainly this should be placed on the agenda for future research.

Also worthy of future consideration is the role played, particularly in recent years, by flexible compensation schemes. The diffusion of income sharing schemes in Italian manufacturing is likely to affect significantly both the composition of pay and its dynamic. The phenomenon, although growing fast, is still limited in size and some time will be necessary before any significant effect is to be observed.

In conclusion, it appears worthwhile to summarise the main contributions made by the work contained in this thesis. Firstly, the search for an adequate explanation of wage determination processes in Italian manufacturing has been addressed contrasting the implication of competitive theories *vis a vis* alternative non-competitive theories. Econometric models have been estimated using different micro-economic data sets containing information on earnings and on individual and firm characteristics. The predictions of different models have been compared and the relevance of non-competitive factors in explaining several wage phenomena has been emphasised. Since very little work, to date, exists for Italy, it is hoped that the results contained herein can both contribute to a better understanding of wage determination mechanisms, and also stimulate further research in the area.

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